A COMPARATIVE STUDY OF THE LENGTHS OF STAY OF MATCHED GROUPS OF INPATIENTS TREATED IN CIVILIAN, UNITED STATES ARMY, NAVY, AND AIR FORCE HOSPITALS

by
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USAF, MSC

Unlimited

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Written during the residency year
under the direction of
Captain David R. Pitts, Preceptor
Office of the USAF Surgeon General
Washington, D.C.

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"The views expressed herein are those of the author and do not necessarily reflect the views of the U.S. Air Force or the Department of Defense."

PREFACE

In addition to fulfilling an academic thesis requirement, this study offered an opportunity to participate in a Department of Defense health study group. That group, the Health Personnel All-Volunteer Task Force, was formed to study the present utilization of resources -- particularly personnel; to investigate alternative patterns of care; and to report its findings to the Office of the Assistant Secretary of Defense (Health and Environment). This writer's interest in a comparative study of lengths of stay was aroused by a health care cost study conducted for the Navy by the Boeing Corporation. The medical task force shared my interest and provided the resources and authority necessary for me to pursue the study.

This study required considerable data input from the Army, Navy, and Air Force inpatient data systems and extensive computer processing. Consequently, the support and cooperation of many individuals was sought and, fortunately, received. I would like to take this opportunity to thank all of those individuals who assisted me

in the completion of the study and to specifically thank several who made very substantial contributions.

Special thanks must go to my preceptor, Captain David R. Pitts who is the Assistant to the President for Administrative Affairs of the Uniformed Services University of the Health Sciences, for establishing my contact with the task force and providing invaluable advice, resources, and moral support throughout the course of this study. Furthermore, an attempt at a tri-service study would have been impossible without the official and personal influence exerted by Lieutenant Colonel John E. Murphy, Chief of the Health Personnel All-Volunteer Task Force. I thank him and all of the members of the task force for their efforts in my behalf.

I am indebted also to my thesis advisor, Dr. Vernon E. Weckwerth for his expert guidance throughout all of the phases of this study, particularly in the area of statistical analysis.

Further appreciation must be extended to Miss Mary-Josita Reding; Mr. Edward E. Wieben, Sr.; and Dr. John J. Bircher of the Biometrics Division, Office of the Surgeon General, for their generous assistance in the design and analysis portion of the study. In addition, I must recognize the fine efforts of Technical Sergeant Charles A. Grant in converting tri-service patient data to a single format and extracting the patient samples

needed for this study. He certainly has my thanks for the use of his expertise and, especially, his perseverance. Also, the graphic skills of Technical Sergeant Robert E. Fontaine added immensely to the quality of the paper and I thank him for his time and efforts.

Finally, my deepest gratitude to my daughter, Stacy, for her patience; and to my wife, LeEtta, for her understanding throughout the course of the study and for typing this paper at an undisclosed cost to this writer.

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Office of the USAF Surgeon General
Washington, D.C.

March 15, 1974

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I INTRODUCTION

A - Scope of the Study

The health care delivery system has been the target of considerable and increasing public scrutiny during the past several years. Spurred on by consumers and third party payers who are concerned about the rising cost of health care, the federal government has become quite active in regulating the activities of providers of health care -- with special attention being afforded to the institutional health care provider.

It appears that the federal government is dedicated to controlling the costs of health care, and that each federal health program is ultimately designed to achieve that end. Programs such as those promoting comprehensive health planning, professional standards review organizations, and health maintenance organizations certainly have significant cost reduction implications. This drive to reduce health care costs is a result of the federal government's experience with the dramatic inflation of health costs which accompanied the Medicare program, and is becoming more intense as the probability

of expanded federal health care involvement grows.

Increasing health care costs are not unique to the civilian health care sector. The military health care systems have also experienced cost increases in recent years. The Department of Defense has increased its outlays for medical and health-related activities* from $2.4 billion in fiscal year 1972** to approximately $2.7 billion in fiscal year 1973, and fiscal year 1974 expenditures are expected to be nearly $2.9 billion.[1] In view of the federal government's increasing role in the health care arena, one would expect the government to eventually turn its attention to ensuring that the dollars expended within the federal health care systems are being utilized in the most effective manner. This process has begun. Several studies are currently being conducted by agencies of the executive and legislative branches of the federal government to evaluate the

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* Medical and health related activities include: health research, training and education of health personnel, construction of health facilities, administrative activities, direct and indirect medical services, and prevention and control.

** Federal fiscal years begin on July 1 of each year and continue through June 30 of the next calendar year.

1. Information obtained from Colonel Robert M. Edwards, Chief, Directorate for Planning and Management, Office of the Assistant Secretary of Defense (Health and Environment), January 15, 1974, in personal interview.

effectiveness of health care delivery within the military health care system.

Those evaluations of the Department of Defense (DoD) health care delivery systems have created a sincere effort within the DoD to objectively evaluate the effectiveness and efficiency of those systems. This study evolved as a result of these efforts by the Department of Defense.

This study represents the efforts of a U.S. Air Force health care administrator to evaluate one measure of efficiency in the delivery of military health care -- the length of inpatient stay in acute care facilities. Specifically, this study compares military medical services -- the U.S Army, U.S. Navy, and U.S. Air Force medical departments. Each military medical service's length of stay experience for ten primary discharge diagnoses is compared to the experience of the other military services and civilian length of stay data extracted from the Commission on Professional and Hospital Activities publication, Length of Stay in PAS Hospitals, United States, 1972.* The comparisons in-

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* PAS hospitals are those hospitals which participate in the Professional Activity Study, a study of hospital practice conducted by the Commission on Professional and Hospital Activities.

volve samples of patients who were discharged during calendar year 1972 from medical facilities within the continental United States and who are matched in terms of primary discharge diagnosis, age group, sex, DoD beneficiary category, whether they were treated for a single diagnosis or multiple diagnoses, and whether they did or did not undergo surgery.

The purpose of these comparisons is to establish quantitatively whether differences in the management of hospitalizations exist among the military health care systems and between each military medical system and the private sector. These differences, if found, could indicate the unnecessary use of acute health care resources and signal the need for a more intense evaluation of hospital utilization within the Department of Defense health care system.

B - The Organization and Functions of the Department of Defense Health Care Delivery Systems

Since many readers may be unfamiliar with the military health care system, a brief explanation of the organization of the system is necessary at this point.

As a portion of his responsibilities of exercising general direction and control over the Department of Defense, the Secretary of Defense establishes policies and issues directives concerning the provision of health care to the uniformed military services of the United

States. The particular health care benefits to be extended to active duty military personnel, their dependents, retired military personnel, and their dependents are established by law. The Secretary of Defense must then convert those legislative programs into reality through the efforts of the DoD health care system. The organizational structure of the DoD health care system is displayed in Table 1.

To assist in that immense task is the Assistant Secretary of Defense (Health and Environment) who serves as the principal advisor and coordinator for the Secretary of Defense on all health and environmental quality matters. The Assistant Secretary of Defense (Health and Environment) and his staff of military physicians, dentists, nurses, health care administrators, and civil service employees are organized as shown in Table 2 and are responsible for performing the following management functions:

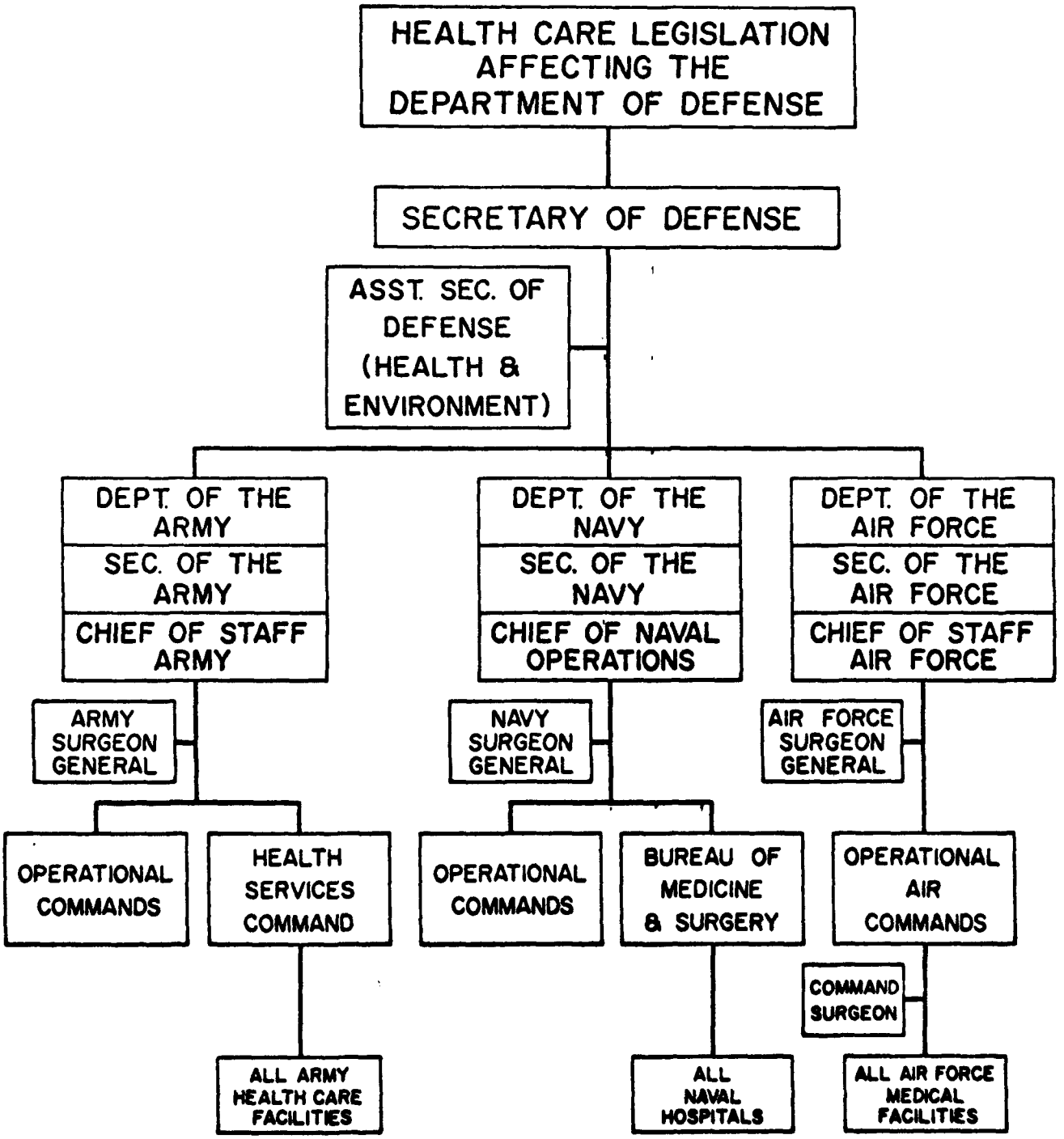
a. Recommending policies and guidance governing Department of Defense health planning and program development.

b. Developing systems and standards for the administration and management of approved plans and programs.

c. Reviewing and evaluating programs of Department of Defense components for carrying out approved policies and procedures.

d. Establishing requirements for Department of Defense research and development programs in relevant fields to be carried out by the Director of Defense Research and Engineering, and keeping abreast of technical developments

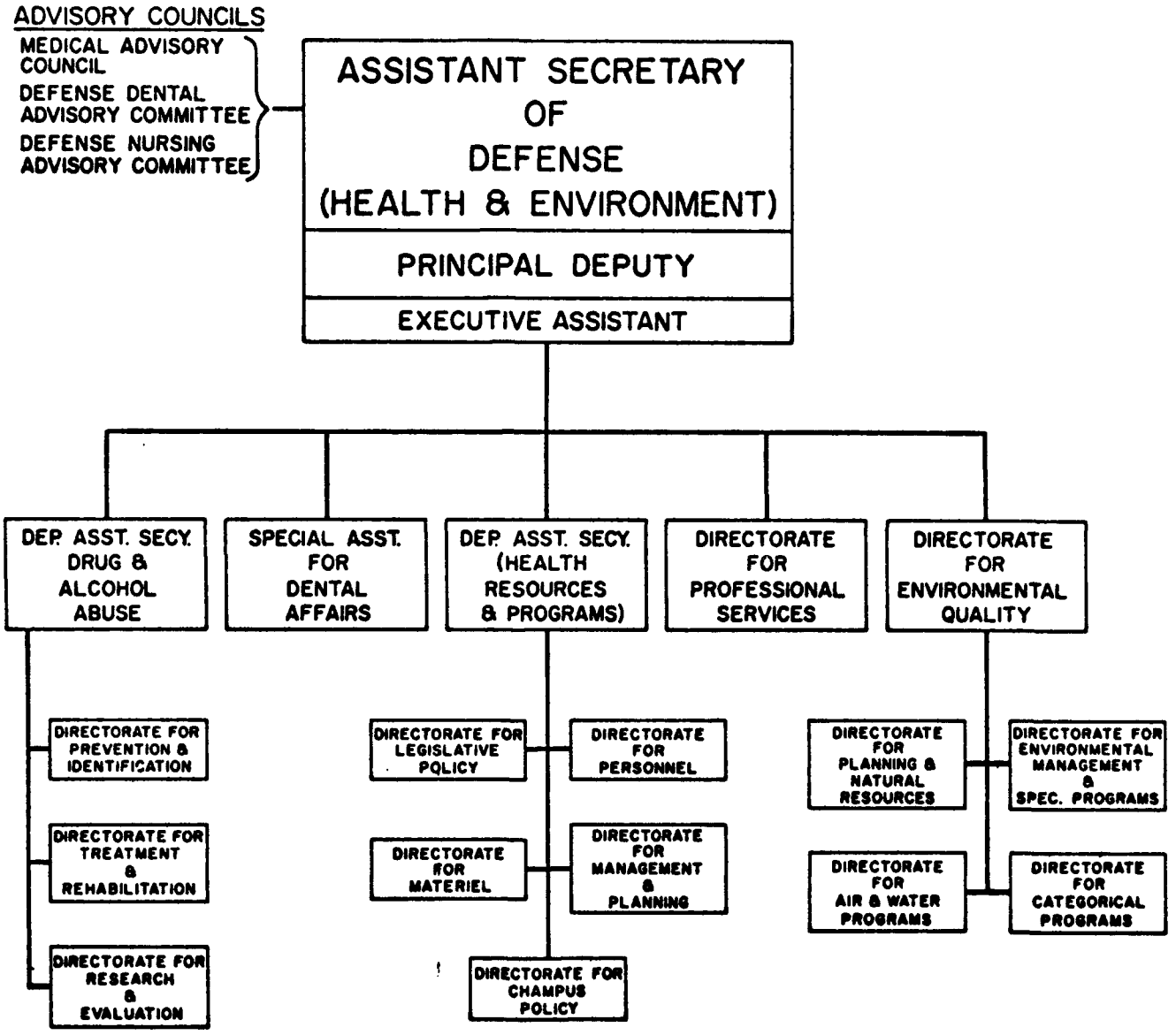
ORGANIZATIONAL STRUCTURE
DEPARTMENT OF DEFENSE
HEALTH DELIVERY SYSTEM[2]
Table 1



2. Information obtained from Major George Rider, from the Directorate for Planning and Management, Office of the Assistant Secretary of Defense (Health and Environment), January 15, 1974, personal interview.

ORGANIZATIONAL STRUCTURE
OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
HEALTH & ENVIRONMENT[3]

Table 2



3. Ibid.

to provide their orderly transition to operational status.

e. Recommending appropriate steps which will provide for more effective, efficient and economical administration and operation in the Department of Defense including the elimination, transfer, reassignment and consolidation of functions.

f. Promoting close cooperation and mutual understanding between the Department of Defense, other federal agencies and the civil health and medical professional.

g. Providing specific policy and guidance for the procurement, professional development, and retention of medical and dental personnel, as well as such other personnel as may be required to discharge Department of Defense health and environmental quality responsibilities.

h. Providing policy guidance, management control, and coordination for the Department of Defense Drug Abuse Control Program and the Department of Defense Alcohol Abuse Control Program. These programs include educational and informational materials on the dangers of illegal or improper drug and alcohol use.[4]

The programs, policies, and directives developed by the Office of the Assistant Secretary of Defense (Health and Environment) are dependent upon the approval of the Secretary of Defense and his line of authority for implementation. After such approval, the policies and directives are desiminated to the next level of organization in the DoD health care system -- the respective Secretaries of the U.S. Army, U.S. Navy, and U.S. Air Force.

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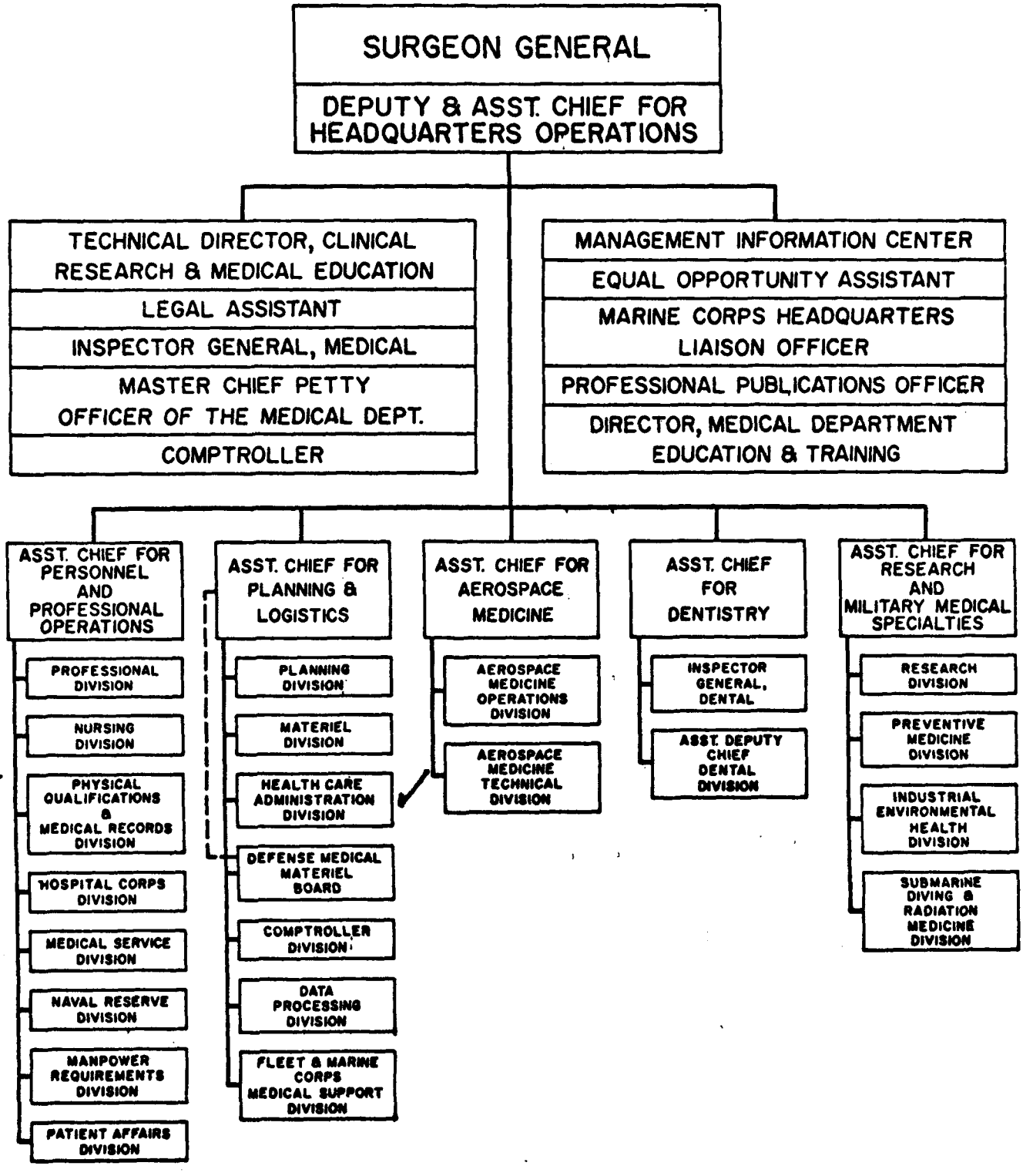
4. "Assistant Secretary of Defense (Health and Environment)," Department of Defense Directive, No. 5136.1, pp. 2-3.

The Secretaries of the military services rely on their respective Surgeon General for staff support and advice on matters pertaining to the delivery of health care. Just as the Assistant Secretary of Defense (Health and Environment) has no line authority within the military health care system, nor do the Surgeons General possess such authority. They develop policies, programs, and procedures which adapt the overall DoD policy to their own military department's operational and organizational requirements, but cannot force implementation without approval from their respective Chief of Staff.

The Surgeons General maintain staffs of health professionals to assist them in the management of their health care delivery subsystem. Each Surgeon General maintains a staff which carries out the functions of health planning, financial management, materiel management, facility planning and programming, management of professional services, personnel planning and management, research and development, and medical information system development and management. Although the Offices of the Surgeons General contain similar functions, they are structured somewhat differently. Those organizational structures can be compared by referring to Tables 3,4, and 5.

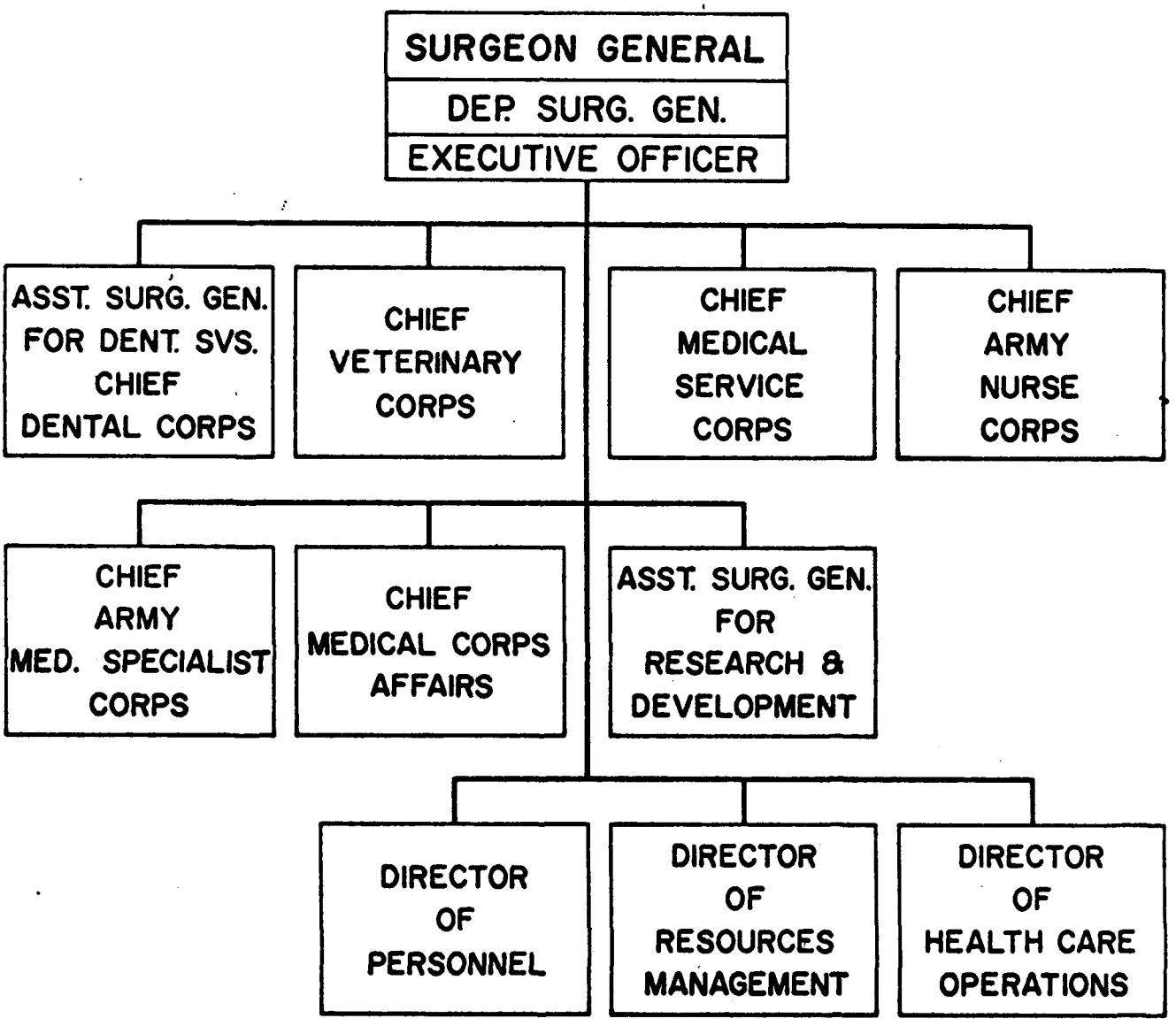
The differences among the three military medical departments are not confined to the Surgeon General level. Variances also exist in the lines of authority among the Chief of Staff of the Army, the Chief of Staff of the

ORGANIZATIONAL STRUCTURE
BUREAU OF MEDICINE AND SURGERY
UNITED STATES NAVY[5]
Table 3



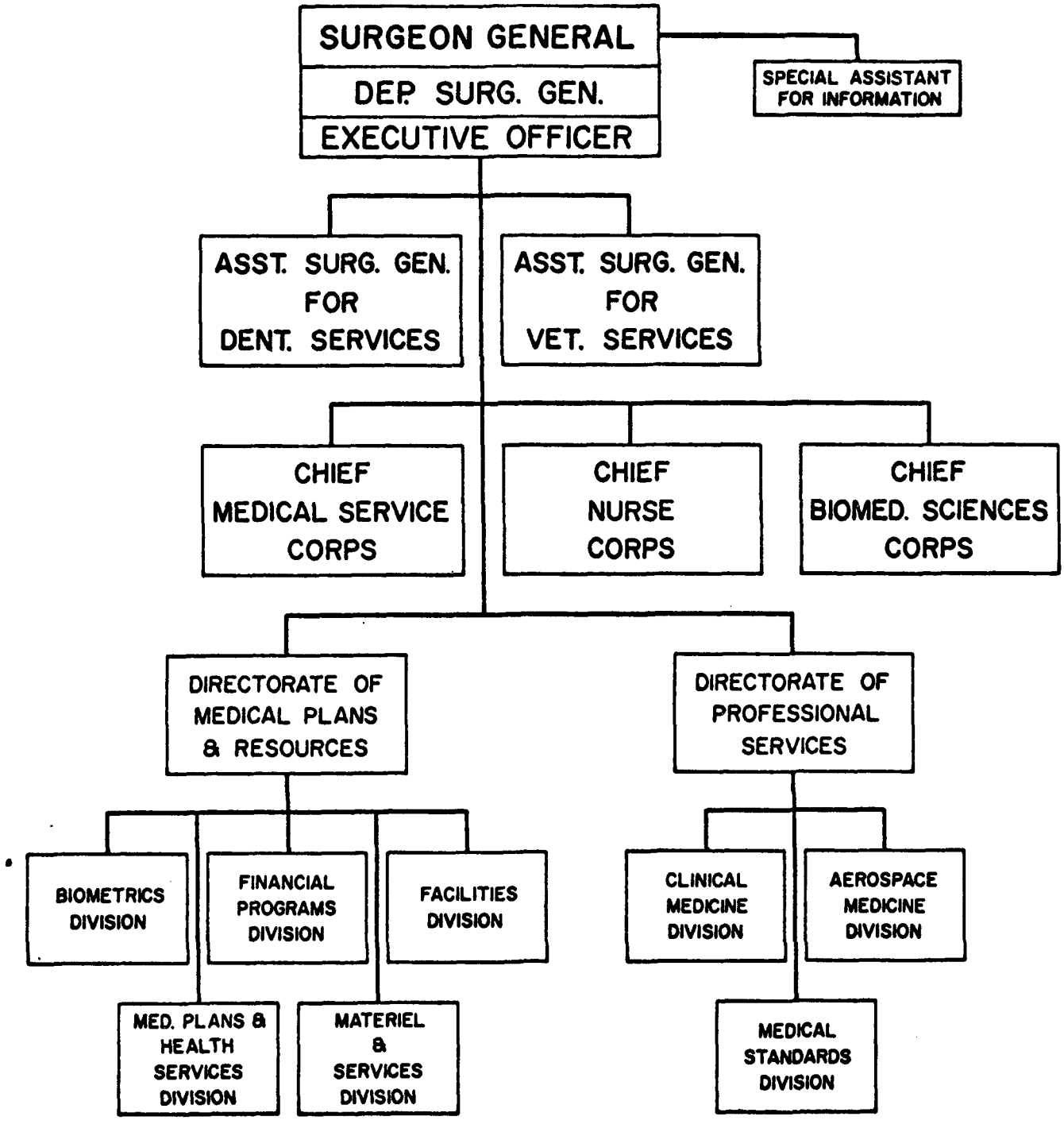
5. Military Medicine, vol. 39 (January, 1974) p. 52.

ORGANIZATIONAL STRUCTURE
OFFICE OF THE SURGEON GENERAL
UNITED STATES ARMY[6]
Table 4



6. Ibid., p. 56.

ORGANIZATIONAL STRUCTURE
OFFICE OF THE SURGEON GENERAL
UNITED STATES AIR FORCE[7]
Table 5



7. Ibid., p. 54.

Air Force, and the Chief of Naval Operations and their respective operational medical facilities.

The Army reorganized its medical department in July, 1973, and established a separate Health Services Command. The Health Services Command is intended to function as the single manager for health care delivery by Army hospitals, clinics, dental facilities, veterinarian facilities, and other health activities within the continental United states. Medical units operating outside of those limits function under the authority of the Army command responsible for their geographic area or functional element. The Army Surgeon General exercises indirect control over the Health Services Command through policies, programs, and procedures which he initiates and are approved by the Secretary of the Army.

The Naval Bureau of Medicine and Surgery maintains centralized control of all Naval medical activities. All Naval hospital commanders are directly accountable to the Chief of the Bureau of Medicine and Surgery. On an organization chart, it appears that the Surgeon General of the Navy also performs solely a staff function for the Chief of Naval Operations. In reality, however, the Surgeon General of the Navy and the Chief of the Bureau of Medicine and Surgery are the same person. Therefore, the Surgeon General of the Navy is able to exercise line authority through his position as the Chief of the

Bureau of Medicine and Surgery.

Unlike the Army and Naval centralized medical management systems, the Air Force administers its medical activities through the major command structure which exists to support the flying mission. This structure places a Command Surgeon in a staff position at each Major Air Command Headquarters. Each Command Surgeon is responsible to both the USAF Surgeon General and the Commander of the Major Air Command. After he has supplemented the USAF Surgeon General's policies and programs to ensure that they are viable in relation to the operational demands of his Major Air Command, the Command Surgeon must provide guidance to the lower echelons of the medical service for the implementation of those policies and programs.

The requirements of law and the resulting health programs developed within the military health care hierarchy described above finally sift down to those who manage the system's health care facilities. It is at this level that the DoD health care system must perform adequately if it is to achieve its primary objective of maintaining the health of armed services personnel at a level which will ensure the highest degree of combat readiness and effectiveness.

A secondary objective which consumes a substantial portion of health care resources is to provide, as resources permit, comprehensive medical care to dependents of active duty military personnel, retired military personnel, and the dependents of retired personnel.

The medical and preventive care necessary to achieve those objectives is delivered through a worldwide network of DoD health care facilities which are staffed and managed by the three military medical services. Although the military medical services are striving toward the same objectives, their concepts of care differ.

The delivery of health care within the Army and Navy health care subsystems is dominated by large medical centers such as the U.S. Army's 1579 bed Walter Reed Medical Center in Washington, D.C., and the 875 bed San Diego Naval Hospital in San Diego, California. These centers are primarily tertiary care medical complexes with a full complement of supporting agencies providing such services as civil engineering, data processing, supply, and personnel management. Primary and secondary medical care are also provided at these medical centers, but the smaller hospitals and dispensaries at operational installations provide the majority of such care.

In contrast, the Air Force provides medical care through a concept of community hospitals. Each Air Force base is supported medically by a hospital or dispensary which is staffed and equipped in accordance with that particular base's health needs. Only the 1000 bed Wilford Hall USAF Medical Center in San Antonio, Texas, is comparable in size to the large Army and Naval Medical Centers. Although they are smaller than their Army and Naval counterparts, Air Force Medical Centers also treat referral patients with complicated medical problems which cannot be adequately cared for in smaller Air Force medical facilities.

Through its network of medical centers, hospitals, dispensaries, and clinics, the DoD health care delivery system provides medical, dental, and preventive care to an estimated ten million health care beneficiaries. These beneficiaries include active duty military personnel, dependents of active duty personnel, retired military personnel, and dependents of retired military personnel. Various other groups of individuals, such as U.S. Coast Guard and U.S. Public Health Service personnel, are treated in military medical facilities, but, in aggregate, account for only 15% of the system's total bed days per year. A summary of the care provided in DoD medical facilities is presented in Table 6.

Because DoD health care facilities exist primarily to provide medical care to the active duty military population, authorized medical care is made available

SELECTED WORKLOAD STATISTICS FROM THE DEPARTMENT OF DEFENSE HEALTH CARE SYSTEM[8]

Table 6

	FY 1970	FY 1971	FY 1972	FY 1973
Total Operating Beds	54,899	48,886	40,178	36,048
Total Number of Beds Occupied (Daily Aver.)	38,591	32,438	26,969	24,210
Total Number of Admissions	1,212,611	1,142,268	1,059,209	1,008,694
Total Number of Out-patient Visits	52,996,391	51,822,457	50,254,616	49,673,730
Number of Live Births	148,711	147,832	132,574	120,011
Beds Occupied by AD Military Personnel (Daily Aver.)	26,605	20,556	15,588	13,352
Beds Occupied by Retired Military Personnel (Daily Aver.)	2,235	2,417	2,501	2,406
Beds Occupied by Dependents of AD Military Personnel (Daily Aver.)	5,903	5,742	5,319	4,914
Beds Occupied by All Other Beneficiaries	3,748	3,723	3,561	3,433

8. Edwards, personal interview.

to other beneficiary groups as health resources permit. The determination as to the extent of care to be provided to non-active duty military patients is made by each military medical facility commander.

The principal recipient of DoD dental and preventive care is the active duty military population. Retired military personnel and their dependents are provided dental care on a space available basis, while dependents of active duty personnel are eligible for dental care only in areas which are officially designated as "isolated".

Preventive care is provided to all beneficiaries in varying degrees. Preventive care for active duty military personnel takes the form of periodic physicial examinations and a mandatory immunization program. Immunizations are also available for other beneficiaries, but physical examinations are normally provided only in conjunction with medical care for a specific condition.

When military health resources in an area are inadequate to care for non-active duty military health beneficiaries, those beneficiaries can turn to the civilian community's health resources for care. The Civilian Health and Medical Program of the Uniform Services (CHAMPUS) is a cost sharing program which enables the families or survivors of active duty and retired military personnel to purchase medical care from

civilian sources at nominal cost to the service family.

Actually, CHAMPUS is a major subsystem of the DoD health care system, and offers the beneficiaries delineated above an alternative method of obtaining health care. Those beneficiaries are free to utilize CHAMPUS to obtain outpatient care at any time. CHAMPUS will pay 80% of the outpatient bill after the individual seeking care has paid a $50 deductible for the year, or his family has paid a total deductible of $100 for the year. CHAMPUS inpatient benefits are available only after the beneficiary has established that the care he needs is unavailable in a nearby military medical facility (within a 30 mile radius) and has obtained a statement that required care is not available from that facility. Exceptions to that rule are beneficiaries who are living apart from their active duty or retired military sponsor and those beneficiaries needing emergency care. Inpatient benefits under CHAMPUS compare quite favorable to benefits offerred by civilian third party payors. The CHAMPUS beneficiary must pay $ 3.50 per day or a $25 total for each inpatient stay, whichever is greater.[9] The balance of the hospital costs are paid by CHAMPUS.

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9. Information obtained from Lieutenant Colonel Norman Penner, from the Directorate for CHAMPUS Policy, Office of the Assistant Secretary of Defense (Health and Environment), February 19, 1974, in personal interview.

As one can see by examining Table 7, the costs of the CHAMPUS program have also grown dramatically in the past several years. This growth is due to many factors. Among them are the liberal benefit policies which CHAMPUS has followed in the past; the large number of dependents living apart from their sponsor during the Vietnam conflict; and, more recently, the critical shortage of physicians in the military medical services which severely limits the availability of care to military dependents in military medical facilities.

Through the military medical services and CHAMPUS subsystems described above, the DoD health care delivery system has been able to achieve its objectives of maintaining healthy fighting forces and providing comprehensive health care to its beneficiaries. However, in this writers opinion, if the DoD health care system is to meet its objectives in the future, it must manage its health resources more effectively. This improved management will, undoubtedly, involve stricter controls on the use of health care resources.

C - Literature Review

A review of the literature concerning an inpatient's length of stay in an acute care facility reveals that the subject has not been neglected by previous researchers. The bulk of the work done, however, seems to be

CHAMPUS WORKLOAD AND COST DATA FY 1970-FY 1973[10]

Table 7

	Total Claims Paid	Total Cost (000)	In-patient Cost (000)	Out-patient Cost (000)	Drug Cost (000)	Adjunctive * Dental (000)	Handicapped Program (000)
FY 1970	1,686,601	$270,272	$235,449	$ 20,619	$ 2,853	$ 4,776	$ 6,575
FY 1971	1,987,404	325,175	276,760	27,812	3,835	8,362	8,346
FY 1972	2,330,707	386,166	314,898	37,127	4,931	19,182	10,028
FY 1973	2,506,090	420,265	336,938	43,346	5,419	24,097	10,465

*Adjunctive dental care is that dental care, including restorative dentistry and dental prosthetic devices, required to augment medical or surgical treatment of a primary condition other than dental.

10. Ibid.

concerned with establishing relationships between independent variables such as a patient's age, sex, race, diagnoses, mode of payment, services provided, and the patient's length of stay in the acute care facility.[11] Other, more ambitious, researchers have attempted to develop models which would enable managers to utilize those relationships to predict a patient's length of stay.[12]

Despite the abundance of research related to length of stay, very few studies have dealt directly with comparisons of the lengths of stay experienced in military and non-military hospitals. These few studies which are applicable to this research effort proved to be extremely useful in that they established a foundation on which this study could build and, hopefully, improve.

In his 1969 thesis for the University of Iowa, "A National Comparison of Lengths of Stay Between Federal Short-term General Hospitals and Non-federal Short-term General Hospitals," D.H. Fisher sought to

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11. R. Hopkins Holmberg, "The Relation of Certain Factors to Length of Inpatient Stay," p. 18; Estelle James, Egon Neuberger, and Florence Neuberger, "Hospital Length of Stay -- A Preliminary Analysis," p. 9.

12. George Joseph Foegen, "A Study of the Use of Stepwise Multiple Regression in the Prediction of Length of Hospitalization of Lower Extremity Injury Patients," pp. 1-10.

determine whether the former experienced a longer length of stay than the latter.[13] He included military hospitals in this comparison under the category of federal short-term general hospitals along with Public Health Service, Indian Service, and Veterans Administration hospitals. The study included only federal and non-federal hospitals which were within the 200 to 400 bed size range. Fisher utilized a questionaire as his data gathering instrument. A portion of the questionaire asked the administrator of each sample hospital to estimate the average length of stay for surgical, medical, and orthopedic service patients, in addition to the average length of stay for all patients. The lengths of stay for the two hospital categories were then compared by using the Kolmogorov-Smirnov one-sample test. As a result of that analysis, Fisher concluded that patient lengths of stay in federal short-term general hospitals were longer than in non-federal short-term general hospitals.

Another, more complex, comparison of lengths of stay in military and civilian hospitals was conducted for the U.S. Navy by John J. Waggoner of the Boeing Corporation.[14]

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13. David Howard Fisher, "A National Comparison of Lengths of Stay Between Federal Short-term General Hospitals and Non-federal Short-term General Hospitals," pp. 1-79.

14. John J. Waggoner, "The Extent of Extended Care of Active Duty Personnel," pp. 1-24.

In a preliminary portion of his 1973 study, "The Extent of Extended Care of Active Duty Personnel," Waggoner compared the lengths of stay experienced by CHAMPUS; the Kaiser-permanente Medical System in Portland, Oregon; hospitals participating in the Commission on Professional and Hospital Activities' Professional Activities Study (PAS); and Naval hospitals. In an effort to make his comparisons between similar groups of patients, Waggoner divided the data into diagnostic groups. These divisions were based upon the 17 diagnostic categories presented in volume eight of the International Classification of Diseases, Adapted.[15] The results of this preliminary comparison indicated that patients treated in Naval hospitals were experiencing an average length of stay which was, in most diagnostic categories, two to three times greater than that of the other health care providers studied.

Waggoner refined his study by matching Naval length of stay data with PAS data in terms of the specific primary diagnosis treated and the patient age group. He then compared the average lengths of stay of the matched Naval and PAS groupings and concluded: "Judging from the overall aggregates, it appears that Naval and Marine

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15. International Classification of Diseases, Adapted, pp. 1-45.

Corps personnel spend from 2.5 to 3.5 times as long in military hospitals than do civilians in the private sector."[16]

Waggoner's conclusions were weakened to some degree by shortcomings in the Naval data which he used. During the period covered by his study, July-December, 1969, the Navy Medical Data Center could provide Waggoner with only the number of sick days by diagnosis. Sick days included not only the information which Waggoner sought, the number of occupied bed days, but also the number of non-hospital convalescent days necessary before the patient could return to duty. Because of that difficulty, Waggoner was forced to determine the percentage of an average Naval hospital stay which was spent in a hospital bed and apply that average to each patient's stay. The degree to which that averaging affected the results of the study is unknown.

James L. Norton also compared Naval and civilian hospital length of stay data in his 1973 study, "A Comparative Analysis of Military and Civilian Health Care Delivery Systems."[17] Specifically, he compared the average lengths of stay at the OAK Knoll Naval Hospital

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16. Waggoner, p. 10.

17. James L. Norton, "A Comparative Analysis of Military and Civilian Health Care Delivery Systems," pp. 1-50.

for 19 diagnoses of 27 Iowa hospitals and Silas B. Hays Army Hospital for the same diagnoses. Norton used a "t" test, utilizing pooled variances, to compare the mean lengths of stay at the .01 level of significance. He concluded that patients admitted with any of the observed diagnoses stay no longer at Oak Knoll Naval Hospital than those admitted for the same diagnoses at Silas B. Hays Army Hospital. However, Norton's analysis did reveal that the lengths of stay at Oak Knoll Naval Hospital were greater than those at the Iowa hospitals for 6 of the 19 diagnoses studied. Since those differences represented only about one-third of the diagnoses studied, he concluded that the effects of free medical care on length of stay were not as great as some critics of national health insurance had feared.

Norton's findings concerning no differences between lengths of stay in Oak Knoll Naval Hospital and Silas B. Hays Army Hospital may not be transferable to military hospitals as a whole. A 1973 survey conducted by the United States General Accounting Office (GAO) stated that, "the average length of hospital stay for all diagnoses for active duty personnel among the military services varied by as much as 12 days, while the length of stay for retirees, dependents, and other patients

was relatively consistent."[18] The GAO study involved the examination of medical records for 650 active duty military personnel who had been hospitalized for one of six emergency/non-emergency diagnoses and for 400 other DoD health care beneficiaries. The GAO attributed the differences in length of stay to lack of uniform policies and procedures concerning the admission and discharge of patients and the granting of convalescent leave. That view point was clearly displayed in the conclusion of the GAO survey letter to the Secretary of Defense:

> We believe that the circumstances found at the six hospitals indicate that the length of time patients are kept in hospital status is subject to administrative procedures and controls as well as medical determinations and that improved administrative and medical practices can reduce the average number of days in hospital status. DoD guidance should set forth the administrative procedures and practices to limit the lengths of hospitalization to that period which is necessary.[19]

The general validity and universal applicability of the GAO study findings are limited by the small number of observations (approximately ten per hospital diagnosis). However, the point that the length of stay

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18. U.S. General Accounting Office Letter Report (B-133142) to Secretary of Defense, March 23, 1973, pp. 1-7.

19. Ibid., p. 7.

is affected by administrative as well as medical considerations is, indeed, accurate. Admission procedures, reporting of ancillary test results, treatment scheduling, and discharge procedures are just a few examples of administrative tasks which, if inefficiently managed, may lengthen the patient's length of stay and, perhaps, adversely affect the quality of care provided in a medical facility.

By increasing the patient's length of stay, administrative and medical mismanagement result in an unnecessary use of valuable health care resources. The relationship of desired medical outcome, length of stay, and the utilization of resources was very effectively presented in model form by Estelle James, Egon Neuberger, and Florence Neuberger in their study, "Hospital Length of Stay -- A Preliminary Analysis." That model is presented below:

$$DR_i = DR_i\ (LOS_i, LOSP_i, PH_i, RI_i/S) \text{ where:}$$

DR_i = degree of recovery of the i^{th} patient as measured by a vector of characteristics which can be assigned cardinal or ordinal values.

LOS_i = hospital length of stay for patient i.

$LOSP_i$ = post-hospital length of stay (at home or extended care facility) for patient i.

PH_i = services of attending physician for patient i.

RI_i = real inputs of goods and services (except for the attending physician) into the i^{th} person's recovery (e.g. hospital beds, lab tests, nurses), $RI_i = RIC_i + RIS_i + RIF_i$ where:

RIC_i = real inputs of goods and services which are complementary with LOS so that their usage varies positively with LOS; their average daily usage may be held constant, increasing or decreasing as LOS changes.

RIS_i = real inputs of goods and services which are substitutable for LOS so that their usage varies negatively with LOS; consequently the average daily usage varies even more inversely with LOS.

RIF_i = real input of goods and services, such as admissions and billing costs, which are fixed for patient, independent of his LOS; their daily usage obviously falls as LOS increases.

S = the economic system or decision-making process connected with the medical care of patient i; this is treated as a parameter for a given hospital and physician, but becomes an important variable when comparing hospitals, physicians, or time periods.[20]

Assuming that the degree of recovery (DR_i) is held constant, then any prolongation of the length of stay (LOS_i) beyond the point where the other inputs are sufficient to achieve that recovery will result in an overutilization of goods and services (RIC_i). This overutilization is a result of the increased use of

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20. James, p. 1.

services such as nursing, housekeeping, and food service which must continue even though the actual acute medical treatment is complete.

Studies such as those discussed above provide valuable insights into the military health care system's management of the inpatient's length of stay. The differences in length of stay shown by those studies may indicate underlying medical or administrative mismanagement. However, one must excercise care when utilizing an <u>average</u> length of stay as a comparative statistic without adjusting for the patient mix involved. In his 1965 article, "How to Use -- and Misuse -- Average Length of Stay," Dr. Vernon E. Weckwerth described an unadjusted length of stay as "a ratio which relates all days to all patients, and in that context is about as useful as the average depth of an average lake.[21] He went on to state that:

> If we wish to retain the average length of stay as a comparative indicator not so crude that it masks the important forces in its movement, it will be necessary to become adept in the use of all manner of specific length of stay indicators. Thus there will be age-specific, sex-specific, age-by-sex-specific, and age-by-sex-by-diagnosis-specific, average length of stay data, so that it is possible to tell whether there are real changes in stay or whether the crude length of stay is merely chang-

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21. Vernon E. Weckwerth, Ph.D., "How to Use -- and Misuse -- Average Length of stay Data," <u>The Modern Hospital</u>, p. 114.

ing as an artifact of changing hospital population composition.[22]

Heeding Dr. Weckwerth's warning against using crude average length of stay statistics in comparative studies, this writer turned to other sources for further examples of characteristics which might improve comparisons of length of stay data.

Several groups are presently actively involved in comparative length of stay studies. The Commission in Professional and Hospital Activities (CPHA) publishes the book, Length of Stay in PAS Hospitals, which is a collection and tabulation of length of stay data from 1800 U.S. and Canadian hospitals. The PAS data are divided into diagnostic categories which are sorted according to age, single diagnosis, multiple diagnoses, and whether surgery was or was not performed.[23] These categorizations are widely used by PAS subscribers to compare their institution's lengths of stay to those of other hospitals in the United States and their geographical area.

In addition to enlarging the markets of organizations such as CPHA, the passage of HR-1 (PL92-603, Social Security Amendments of 1972) mandated the establishment of professional standards review organizations (PSRO) and

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22. Ibid., p. 116.

23. Commission on Professional and Hospital Activities, Length of Stay in PAS Hospitals, United States, 1972, p.lvii.

their development of "peer review," "medical review," and "utilization review" mechanisms. Although the PSRO concept is not fully operational, several programs have developed which achieve the purposes of PSRO. The utilization review procedures of these programs require the establishment of length of stay criteria to which actual practice can be compared. In their article concerning the Hospital Admission and Surveillance Program (HASP) of Illinois, Bruce A. Flashner and his co-authors recommend that length of stay data be categorized as to age, sex, diagnostic characteristics, and recipient categories.[24]

Dr. Weckwerth, CPHA, and HASP seem to agree that categorization must be accomplished in length of stay data in order to accommodate for differences in patient mix, and the categorization factors suggested by each are very similar.

D - Objectives of the Study

The studies discussed in the previous section indicate that there may be differences in the period of hospitalization experienced by patients treated in military hospitals and those treated in civilian hospitals. In addition, the study conducted by the General

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24. Bruce A. Flashner, M.D.; Shirley Reed; Robert W. Coburn; Philip R. Fine, Ph.D, "Professional Standards Review Organizations," p. 1474.

Accounting Office stated that there are significant length of stay differences between patients treated in U.S. Army, U.S. Navy, and U.S. Air Force hospitals. Those studies, while providing valuable information to the health care field, incorporated various shortcomings into their design which may have affected the validity of their findings. Those design difficulties can be summarized as follows:

a) Introduction of biases into the length of stay data (ie. allowing administrators to estimate their institution's average length of stay or estimating occupied bed days).

b) Failure to allow for patient mix in the comparisons of length of stay data.

This author attempted to build upon the contributions of prior researchers and avoid similar design difficulties to achieve the following objectives:

a) Determine through statistical testing whether differences exist between the lengths of stay for patients treated in military short-term general hospitals and those of comparable patients treated in non-federal short-term institutions represented by PAS hospitals' data.

b) Ascertain through statistical testing whether differences in lengths of stay exist among comparable patients treated in U.S. Army, U.S. Navy, and U.S. Air Force hospitals.

E - Premise

The review of previous research and exposure to both the civilian and military health care systems led this writer to arrive at presupposed beliefs concerning the outcome of this study.

The first such conclusion was that there would be a difference between the lengths of stay in PAS hospitals and military hospitals. This preliminary judgment was based on the results of Waggoner's study and basic differences in economic forces at work in the two systems.[25] Civilian hospitals are under considerable pressure from third party payors, the federal government, and patients to reduce costs through controlling hospital utilization. The patient length of stay has been a primary target of that reduction psychology.

Military hospitals, on the other hand, have not had to justify to third party payors or paying patients the elements of care provided. In fact, an incentive exists within the military budgetary system to maximize patient days and services. The number of physicians, funds, and new facilities which each hospital is allocated are based, at least in part, on the number of patient days accrued by that hospital in the prior fiscal year. Therefore, to maximize the availability

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25. Waggoner, p. 10.

of future resources, one must either treat more patients or treat patients longer.

In addition to this rather questionable incentive factor, there is a more valid reason for delaying some patients' release from the military hospital. Many active duty military patients who have reached the point where they no longer require acute medical care, but do need domiciliary care, cannot be discharged from the hospital because they have nowhere to go other than the barracks environment. Domiciliary care facilities could eliminate many patient days in acute care hospitals, but such facilities are not available in adequate numbers at this time.

The factors delineated above will, in this writer's opinion, result in differences between the lengths of stay experienced in civilian and military hospitals. Similarly, it is this researcher's opinion that the policy and procedural differences among the military medical services which were somewhat cursorily examined in the General Accounting Office's study will cause differences in the length of stay experience of the three military medical services.

F - Hypotheses

In order to achieve the objectives of this study, 12 major hypotheses are tested. These major hypotheses are intended to indicate whether differences in lengths

of stay exist among PAS, U.S. Army, U.S. Navy, and U.S. Air Force hospitals for matched groups of patients. The testing of each major hypothesis is dependent upon the results of the testing of ten sub-hypotheses.

Each sub-hypothesis compares matched groups of patients for two of the hospital systems mentioned above to determine if differences in length of stay exist between the two systems for those particular patient groups. The patient groups are matched in terms of the following variables:

a) DoD health care beneficiary group (not applicable for PAS hospitals)
b) Age group
c) Sex (not applicable for PAS hospitals)
d) Primary discharge diagnosis
e) Whether single or multiple diagnoses were recorded
f) Whether or not surgical procedures were performed

The sub-hypotheses are identical in form. In fact, only the patient variables incorporated into each sub-hypothesis differ. Because of this marked similarity, only the sub-hypotheses for the first major hypothesis will be written out completely. For subsequent sub-hypotheses, only variations from the first group of sub-hypotheses are noted.

Both major hypotheses and sub-hypotheses are presented in their operational form. However, the null, or no difference, form of the hypotheses will be tested statistically. The results of each test will indicate whether the null hypothesis should be accepted or rejected. Rejection of the null will indicate that the alternative, in this case the operating hypothesis, should be accepted.

Hypothesis 1:

Active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypothesis 1(a):

The lengths of stay for male active duty military within the 20 to 34 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of gastroenteritis and colitis with no further diagnoses or surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(b):

The lengths of stay for male active duty military patients within the 35 to 49 year age

group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of diabetes mellitus without acidosis or coma with no further diagnoses or surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(c):

The lengths of stay for male active duty military patients within the 35 to 49 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of chronic ischemic heart disease without hypertension or further diagnoses, but with surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(d):

The lengths of stay for male active duty military patients within the 20 to 34 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of hemorrhoids with surgery but no further diagnoses, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(e):

The lengths of stay for male active duty military patients within the 20 to 34 year age group who are hospitalized in U.S. Army medical

facilities for a primary discharge diagnosis of acute upper respiratory infection, except bronchitis, with no further diagnoses or surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(f):

The lengths of stay for male active duty military patients within the 20 to 34 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of pneumonia, except viral, with no further diagnoses or surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(g):

The lengths of stay for male active duty military patients within the 0 to 19 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of asthma, with no further diagnoses or surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(h):

The lengths of stay for female active duty military patients within the 0 to 19 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of hypertrophy

of the tonsils and adenoids, with surgery but no further diagnoses, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(i):

The lengths of stay for male active duty military patients within the 20 to 34 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of inguinal hernia without obstruction or further diagnoses, but with surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Sub-hypothesis 1(j):

The lengths of stay for female active duty military patients within the 20 to 34 year age group who are hospitalized in U.S. Army medical facilities for a primary discharge diagnosis of delivery, without complications or further diagnoses, but with surgery, are different than the lengths of stay for comparable patients hospitalized in PAS hospitals.

Hypothesis 2:

Non-active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypotheses:

Sub-hypotheses 2(a) through 2(j) are the same as sub-hypotheses 1(a) through 1(j), except that only non-active duty military patients are included in the U.S. Army patient sample.

Hypothesis 3:

Active duty military patients hospitalized in U.S. Naval hospitals experience different lengths of stay than patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypotheses:

Sub-hypotheses 3(a) through 3(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Naval hospitals are compared to PAS hospitals.

Hypothesis 4:

Non-active duty military patients hospitalized in U.S. Naval hospitals experience different lengths of stay than patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypotheses:

Sub-hypotheses 4(a) through 4(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Naval hospitals are compared to PAS hospitals and only non-active duty military patients are considered for U.S. Naval hospitals.

Hypothesis 5:

Active duty military patients hospitalized in U.S. Air Force hospitals experience different lengths of stay than patients who are matched in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypotheses:

Sub-hypotheses 5(a) through 5(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Air Force hospitals are compared to PAS hospitals.

Hypothesis 6:

Non-active duty military patients hospitalized in U.S. Air Force hospitals experience different lengths of stay than patients who are matched in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Sub-hypotheses:

Sub-hypotheses 6(a) through 6(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Air Force hospitals are compared to PAS hospitals and only non-active duty military patients are considered for U.S. Air Force hospitals.

Hypothesis 7:

Active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than

active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Sub-hypotheses:

Sub-hypotheses 7(a) through 7(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Army hospitals are compared to U.S. Naval hospitals.

Hypothesis 8:

Non-active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Sub-hypotheses:

Sub-hypotheses 8(a) through 8(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Army hospitals are compared to U.S. Naval hospitals and only non-active duty military patients are included in the matched samples.

Hypothesis 9:

Active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical charac-

teristics but are hospitalized in U.S. Air Force hospitals.

Sub-hypotheses:

Sub-hypotheses 9(a) through 9(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Army hospitals are compared to U.S. Air Force hospitals.

Hypothesis 10:

Non-active duty military patients hospitalized in U.S. Army hospitals experience different lengths of stay than non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Air Force hospitals.

Sub-hypotheses:

Sub-hypotheses 10(a) through 10(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Army hospitals are compared to U.S. Air Force hospitals and only non-active duty military inpatients are included in the matched samples.

Hypothesis 11:

Active duty military patients hospitalized in U.S. Air Force hospitals experience different lengths of stay than active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Sub-hypotheses:

Sub-hypotheses 11(a) through 11(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Air Force hospitals are compared to U.S. Naval hospitals.

Hypothesis 12:

Non-active duty military patients hospitalized in U.S. Air Force hospitals experience different lengths of stay than non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Sub-hypotheses:

Sub-hypotheses 12(a) through 12(j) are the same as sub-hypotheses 1(a) through 1(j), except that U.S. Air Force hospitals are compared to U.S. Naval hospitals and only non-active duty military inpatients are included in the matched samples.

II METHODOLOGY

This study employed a comparative research design in which each hypothesis compared the dependent variable, length of stay, for two matched samples of patients. As the literature review in Chapter I of this study revealed, the validity of such comparisons is dependent upon how successful the researcher is in matching the patient groups which he compares. Obviously, this writer could not achieve a perfect match between the patient characteristics of the groups. However, a sincere effort was made to select very similar patient groups from each of the health care delivery systems considered in this study.

A - Selection of the Samples

The samples of patients were selected from the universe of patients hospitalized between January 1, 1972, and December 31, 1972, in PAS, Army, Navy, and Air Force hospitals which were located in the continental United States.[1] The requirement for matched samples precluded

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1. See Appendix A.

the selection of a simple random sample from that universe of patients. Such a sampling technique would not necessarily result in the selection of comparable patient groups and would certainly have necessitated the collection of a multitude of data which would not have been useful in this study.

For the sake of economy, this researcher chose to select patient samples based on predetermined characteristics. Those characteristics -- independent variables -- were chosen because of their purported correlation with the length of a patient's stay in the hospital -- the dependent variable. The independent variables which were incorporated in matching patient samples are discussed below.

Primary Discharge Diagnosis

Obviously, the degree of seriousness of a patient's malady can affect how long he will require hospitalization. Therefore, the primary discharge diagnosis was the first criterion utilized to select the samples. Time and economic resources did not allow the inclusion of all possible diagnoses in the selection criteria, so a representative group of ten diagnoses was selected. Those diagnoses were chosen because collectively they account for a great number of DoD hospital admissions and appeared on the list of the 25 most frequent

discharge diagnoses.[2] In addition to accounting for a significiant portion of the total DoD admissions, the ten diagnoses provide a good cross-section of conditions treated in DoD medical facilities.[3]

Unfortunately, PAS hospitals utilize the H-ICDA diagnostic coding system which is an adaptation of the ICDA-8 coding system used by the Department of Defense hospitals. Therefore, the DoD and PAS diagnoses do not correspond exactly. However, they are similar enough to allow comparisons to be made between PAS and DoD patients. The ten ICDA-8 diagnoses and the corresponding H-ICDA diagnoses are listed in Table 8.

Age

There seems to be general agreement that lengths of patient stay increase as the ages of the patients treated increase.[4] Intuitively, one

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2. Tri-service Comparability Committee, "Tri-service Comparability Committee Progress Report No. 2," Attachment 1.

3. Information obtained from Miss Mary Josita Reding, December 13, 1973, in personal interview.

4. R. Hopkins Holmberg, "The Relation of Certain Factors to Length of Inpatient Stay," p. 39; Estelle James, Egon Neuberger, and Florence Neuberger, "Hospital Length of Stay -- A Preliminary Analysis," p. 9.

THE TEN ICDA-8 CODES SELECTED FOR STUDY AND THEIR CORRESPONDING H-ICDA CODES[5]

Table 8

ICDA-8 Code	Terminology	H-ICDA Codes	Terminology
009.2	Gastroenteritis and Colitis	001.0-009.9	Intestinal Infectious Disease
250.9	Diabetes Mellitus without Acidosis or Coma	250.0;250.9	Diabetes Mellitus without Complications; Prediabetes
412.9	Chronic Ischemic Heart Disease without Hypertension	411.0-414.0	Ischemic Heart Disease, except Acute Myocardial Infarction
455.0	Hemorrhoids	455.0	Hemorrhoids
465.0	Acute Upper Respiratory Infection, except Bronchitis	460.0-465.0	Acute Upper Respiratory Infection, except Streptococcal
486.0	Pnuemonia, except Viral	480.0-486.0	Pneumonia
493.0	Asthma	493.0-493.9	Asthma
500.0	Hypertrophy of Tonsils and Adenoids	500.0	Hypertrophy of Tonsils and Adenoids
550.0	Inguinal Hernia without Obstruction	550.0;552.0	Inguinal Hernia
650.0	Delivery without Complications	650.0	Delivery without Complications

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5. International Classification of Diseases, Adapted, vol 1, pp. 53, 141, 213-214, 228, 232, 235, 236, 258, 259, 275, 300; Commission on Professional and Hospital Activities, Hospital Adaptation of ICDA, H-ICDA, pp. 51, 108, 203-204, 226, 230, 233, 238-239, 264-265, 285, 318.

can attribute this relationship to the general deterioration of one's physical condition as his age increases. In order to facilitate the comparison of PAS and DoD patients, the age groups which PAS employs in its length of stay book have been used in this study. Those age groups are as follows:

0 -19 years
20-34 years
35-49 years
50-64 years
65 years and older

Sex

The affect of the patient's sex on his length of stay is not as generally agreed upon as the two previous variables. The PAS length of stay studies do not consider sex. However, since the patient's sex is easily discerned, this study has included sex as a variable for DoD patients. Thus, DoD will be sex-specific, but PAS data will not.

Beneficiary Category

DoD patients were divided into two categories -- active duty military patients and non-active duty military patients. The first category is self explanatory. The second category, however, includes dependents of active duty personnel, retired military personnel and their dependents, and all other non-active duty military personnel treated in DoD hospitals. These categorizations were necessary in

order to test the conclusions of the GAO that disparities exist among the lengths of stay for active duty military personnel treated in Army, Navy, and Air Force hospitals; but that the lengths of stay for non-active duty patients are consistent.[6]

Single Diagnosis or Multiple Diagnoses

Treatment for diagnoses in addition to the primary diagnosis can complicate the treatment process and affect the length of stay. The countless possible combinations of multiple diagnoses prohibited matching patients for their specific additional diagnoses. Therefore, for the purposes of this study, patients will be matched according to whether they were treated for a single diagnosis or multiple diagnoses.

With Surgery or Without Surgery

The additional procedures necessary when surgery is performed tend to lengthen a patient's hospital stay. Therefore, the patient sample selection process included a surgical criterion. Patients were simply classified as having had or not having had surgical procedures performed.

The criteria chosen for the selection of the patient groups certainly did not encompass all of the independent

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6. U.S. General Accounting Office Letter Report (B-133142) to Secretary of Defense, March 23, 1973, p. 1-7.

variables which may affect length of stay. Such variables as the patient's race, hospital size and type, physician qualifications, and the adequacy of the patient's insurance coverage may influence the length of stay; but matching patient groups for all possible variables was not possible due to time and monetary constraints. In addition, the use of PAS length of stay data dictated that the variables utilized by the Commission on Professional and Hospital Activities be followed rather closely.

After this researcher determined which independent variables would be used in the sample selection process, those variables were combined to form 20 patient profiles. These profiles facilitated the matching process. In order to ensure that adequate sample sizes could be obtained, this writer attempted to establish profiles under which the maximum number of patients would fall. The first step in this process involved selecting age groups for each primary diagnoses which exhibited the greatest morbidity rate within the DoD health care system. This information was gleaned from an Air Force medical management report.[7] An Air Force report was selected because of the accessibility of such reports to this writer. The

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7. U.S. Air Force Medical Management Report, RRA M0030, "Admissions and Total Days Lost, by Age, EAD UASF Personnel, 1972."

Air Force morbidity experience was assumed to reflect the experience of the total DoD health care system, and profile age groups were determined on that premise.

The remaining variables for each profile were also established with the goal of maximizing the sample size. Since no DoD medical management reports provided information concerning the frequency of multiple diagnoses, whether surgery was performed, or the sex of patients treated for each primary diagnosis, this writer relied upon the judgment and experience of Miss Mary Josita Reding, the Chief Registered Record Administrator for the Office of the USAF Surgeon General for this information. Miss Reding assisted this writer in selecting the remaining profile criteria. The specific patient profiles selected for comparison are as follows:

1) Primary Diagnosis: Gastroenteritis and Colitis
   Single Diagnosis
   Without Surgery
   DoD Beneficiary Category: Active Duty Military (AD)
   Age: 20-34 years
   Sex: Male

2) Same as 1 above, except that non-active duty military patients were selected as the DoD beneficiary category.

3) Primary Diagnosis: Diabetes Mellitus without Acidosis or Coma
   Single Diagnosis
   Without Surgery
   DoD Beneficiary Category: AD
   Age: 35-49 years
   Sex: Male

4) Same as 3 above, except that non-active duty military patients were selected as the DoD beneficiary category.

5) Primary Diagnosis: Chronic Ischemic Heart Disease without Hypertension
Single Diagnosis
With Surgery
DoD Beneficiary Category: AD
Age: 35-49 years
Sex: Male

6) Same as 5 above, except that non-active duty military patients were selected as the DoD beneficiary category.

7) Primary Diagnosis: Hemorrhoids
Single Diagnosis
With Surgery
DoD Beneficiary Category: AD
Age: 20-34 years
Sex: Male

8) Same as 7 above, except that non-active duty military patients were selected as the DoD beneficiary category.

9) Primary Diagnosis: Acute Upper Respiratory Infection, except Bronchitis
Single Diagnosis
Without Surgery
DoD Beneficiary Category: AD
Age: 20-34 years
Sex: Male

10) Same as 9 above, except that non-active duty military patients were selected as the DoD beneficiary category.

11) Primary Diagnosis: Pneumonia, except Viral
Single Diagnosis
Without Surgery
DoD Beneficiary Category: AD
Age: 20-34 years
Sex: Male

12) Same as 11 above, except that non-active duty military patients were selected as the DoD beneficiary category.

13) Primary Diagnosis: Asthma
Single Diagnosis
Without Surgery
DoD Beneficiary Category: AD
Age: 0-19 years
Sex: Male

14) Same as 13 above, except that non-active duty military patients were selected as the DoD beneficiary category.

15) Primary Diagnosis: Hypertrophy of Tonsils and Adenoids
Single Diagnosis
With Surgery
DoD Beneficiary Category: AD
Age: 0-19
Sex: Female

16) Same as 15 above, except that non-active duty military patients were selected as the DoD beneficiary category.

17) Primary Diagnosis: Inguinal Hernia without Obstruction
Single Diagnosis
With Surgery
DoD Beneficiary Category: AD
Age: 20-34 years
Sex: Male

18) Same as 17 above, except that non-active duty military patients were selected as the DoD beneficiary category.

19) Primary Diagnosis: Delivery without Complications
Single Diagnosis
With Surgery
DoD Beneficiary Category: AD
Age: 20-34 years
Sex: Female

20) Same as 19 above, except that non-active duty military patients were selected as the DoD beneficiary category.

The final step in the selection process involved excluding patients who would bias the length of stay data from the DoD health care delivery system. Excluded were patients who died, were transferred from or to another hospital, left against medical advice, or were hospitalized awaiting a military Physical Evaluation Board.

PAS data included similar exclusions with the exception of those awaiting physical evaluations. However, the PAS data also excluded patients who were hospitalized for 100 days or more. This last criterion was not included for DoD patients, because the hospitalization periods for the diagnoses selected would very rarely extend to 100 days or more. The frequency of such occurrences did not justify the computer time involved to exclude those patients.

B - Collection of Data

The inpatient data needed to conduct this study were drawn from the medical data systems maintained by the Commission on Professional and Hospital Activities (CPHA), the Army, Navy, and Air Force. The CPHA is a non-profit, nongovernmental medical research computer center which produces two continuing studies of hospital practice, the Professional Activity Study (PAS) and the Medical Audit Program (MAP). In addition, the CPHA produces special studies for participating hospitals and an annual publication of length of stay data.

The book, Length of Stay in PAS Hospitals, United States, 1972, was the source of the PAS data used in this study. The statistical tables in that book present length of stay data in categories which correspond closely to the patient profiles described in the previous section and a sample table is presented in Table 9. The

EXAMPLE OF PAS LENGTH STAY DATA TABLE[8]

Table 9

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127: Cholelithiasis and cholecystitis (574.0-575.9)

TYPE OF PATIENT (1)	TOTAL PATIENTS (2)	AVG. STAY (3)	VARIANCE (4)	PERCENTILES 5th (5)	10th (6)	50th (7)	75th (8)	90th (9)	95th (10)	99th (11)
1. SINGLE DX										
A. *Not Operated*										
0-19 YRS	662	4.2	9	1	1	4	5	7	9	14
20-34	4847	4.1	9	1	1	3	5	7	9	14
35-49	4855	4.5	10	1	2	4	6	8	10	15
50-64	4903	5.0	12	1	2	4	6	9	11	17
65+	4152	6.6	22	2	2	6	8	12	15	25
B. *Operated*										
0-19 YRS	1648	9.3	14	5	6	8	11	14	16	22
20-34	20105	9.2	13	6	6	8	10	13	16	22
35-49	21215	9.7	15	6	6	9	11	14	17	23
50-64	20983	10.6	19	6	7	9	12	16	19	26
65+	10545	13.5	42	7	8	12	16	22	26	37
2. MULTIPLE DX										
A. *Not Operated*										
0-19 YRS	340	5.3	15	1	2	5	6	9	12	19
20-34	3033	5.5	17	1	2	4	7	10	13	21
35-49	4590	6.2	20	2	2	5	8	11	14	23
50-64	7783	7.0	27	2	2	6	9	13	16	26
65+	13493	9.3	49	3	3	8	12	17	22	35
B. *Operated*										
0-19 YRS	649	11.4	35	6	6	10	14	18	22	30
20-34	9090	11.2	34	6	6	9	13	17	21	34
35-49	14293	12.2	41	6	7	10	14	20	24	37
50-64	20704	13.9	58	7	7	12	17	23	28	43
65+	18717	18.3	109	8	9	16	22	31	38	59
SUBTOTALS:										
1. SINGLE DX										
A *Not Operated*	19419	4.9	14	1	2	4	6	9	11	18
B *Operated*	74496	10.4	21	6	6	9	12	16	19	28
2. MULTIPLE DX										
A *Not Operated*	29239	7.8	37	2	3	6	10	14	18	31
B *Operated*	63453	14.4	73	6	7	12	17	24	30	47
1. SINGLE DX	93915	9.2	25	3	4	8	11	15	18	27
2. MULTIPLE DX	92692	12.3	71	3	4	10	15	22	28	44
A. NOT OPERATED	48658	6.6	30	1	2	5	8	13	16	27
B. OPERATED	137949	12.2	49	6	7	10	14	20	25	40
TOTAL 0-19 YRS	3299	8.3	24	2	3	8	10	14	16	24
" 20-34	37075	8.7	23	2	4	8	10	14	17	25
" 35-49	44953	9.6	29	3	4	9	11	16	19	29
" 50-64	54373	10.8	43	3	4	9	13	18	22	35
" 65+	46907	13.6	87	3	5	11	17	25	31	48
GRAND TOTAL	186607	10.8	50	3	4	9	13	19	23	38

8. Commission on Professional and Hospital Activities, Length of Stay in PAS Hospitals, United States, 1972, p. lvii.

data are compiled from individual patient discharge abstracts submitted by hospitals participating in the Professional Activity Study.[9] Those abstracts are converted by the CPHA staff into computer data files from which information for all CPHA products, including the length of stay book, is extracted. The process required to produce those products is graphically displayed in Table 10.

The length of stay data for the military medical departments are also maintained in computer data files. Each military medical department maintains its own distinct medical information system from which it draws data and produces clinical and management reports. The military departments utilize a system very similar to that of the CPHA to collect inpatient data. Each hospital prepares a case abstract for each inpatient discharged and submits them to its respective military department's medical information center for processing and inclusion in the medical data files.[10] Although the information systems are conceptually similar, the case abstract formats, codes, and content; the computer hardware; and report outputs all vary to such an extent that each system is somewhat unique.

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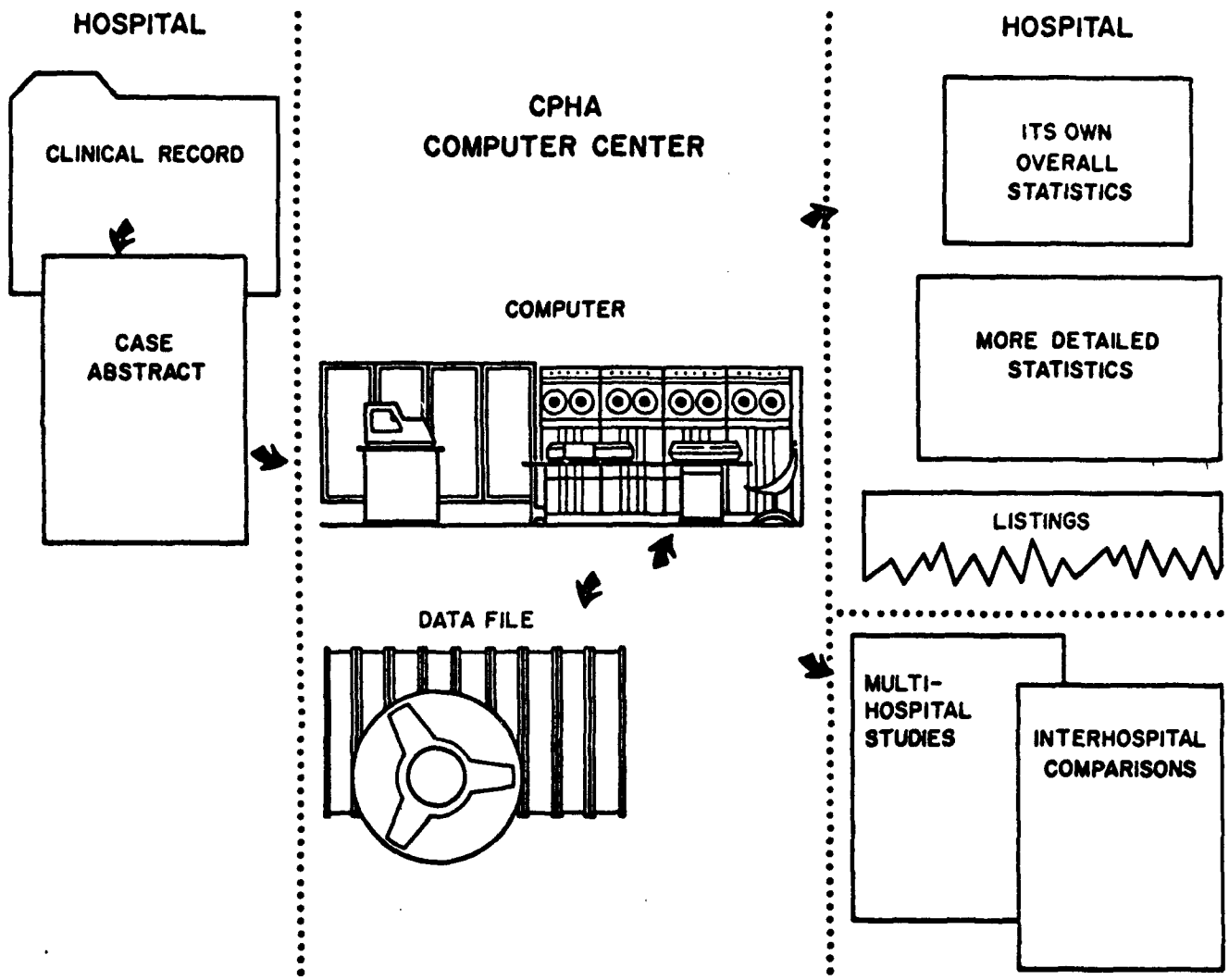
9. See the sample PAS case abstract in Appendix B.

10. See the sample military case abstracts in Appendices C,D, and E.

DIAGRAM OF PAS MEDICAL RECORD INFORMATION SYSTEM [11]

Table 10



11. Length of Stay in PAS Hospitals, United States, 1972, p. xxii.

Unfortunately, the length of stay data required for this study were not readily available from the military medical information systems in the format required. Therefore, it was necessary to draw inpatient data files from each inpatient information system and sort the data into the matched patient groups.

In order to minimize the time and effort required to obtain the matched patient groups from each military service, representatives of the Army and Navy inpatient data systems were requested to transfer all of the 1972 inpatient data for the ten diagnoses being studied onto magnetic computer tapes. Those tapes were then converted by the Air Force to its biometric data format through the use of an existing conversion computer program. Having converted the Army and Navy inpatient data to the Air Force format, it was possible to utilize a single computer program to sort the inpatient data from all three military medical services into the matched patient groups discussed earlier.[12]

The comparisons of the military medical systems' lengths of stay were accomplished through the use of a preprogrammed statistical computer routine. That computer program incorporated parameters which required the size of the samples to be compared to be equal to or greater than 100

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12. See Appendix F.

and no more than 501. If the sorting process described above resulted in samples which exceeded that upper limit, the computer was utilized to select a random sample of 501 patients from the larger sample group. If the sorting process resulted in a sample size which was smaller than 100, the pre-programmed statistical routine was not used. In those cases, the statistical tests had to be calculated manually.

C - The Test Statistic

The Kolmogorov-Smirnov two-sample, two-tailed test was selected to test the sub-hypotheses at the .05 level of significance. The test is essentially a goodness-of-fit test which is designed to determine whether two samples have been drawn from populations with the same distribution. The two-tailed test was utilized because it is sensitive to any kind of difference in the distributions from which the two samples were drawn (e.g., differences in central tendency, indispersion, or in skewness).[13]

Sidney Siegel described the principle of the test as follows:

> If the two samples have in fact been drawn from the same population distribution, then the cumulative distributions of both samples may be expected to be fairly close to each

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13. Sidney Siegel, Nonparametric Statistic for the Behavioral Sciences, p. 127.

> other, in as much as they both should show only random deviations from the population distribution. If the two sample cumulative distributions are "too far apart" at any point, this suggests that the samples come from different populations. Thus a large enough deviation between the two sample cumulative distributions is evidence for rejecting H_o.[14]

The computation of this test statistic is shown in Appendix G.

In order to reach a conclusion concerning each major hypothesis, the probability values for the sub-hypotheses had to be combined to gain a composite value for their respective major hypotheses. The Kolmogorov-Smirnov test is not an additive test. However, the probability values obtained through the use of the Kolmogorov-Smirnov two-sample test can be converted to a Chi-square (X^2) value for two degrees of freedom by using the formula:[15]

$$X^2 = -2(\log_e P)$$

R.A. Fisher described the technique as follows:

> When a number of quite independent tests of significance have been made, it sometimes happens that although few or none can be claimed individually as significant, yet the aggregate gives an impression that the probabilities are on the whole lower than would often have been

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14. Ibid.

15. Information obtained from John Bircher, PhD., Statistician, Biometrics Division, Office of the USAF Surgeon General, February 25, 1974, in a personal interview.

> obtained by chance. It is sometimes desired, taking account only of these probabilities, and not of the detailed composition of the data from which they are derived, which may be of very different kinds, to obtain a single test of the significance of the aggregate, based on the product of the probabilities individually observed.
>
> The circumstance that the sum of a number of values of χ^2 is itself distributed in the χ^2 distribution with the appropriate number of degrees of freedom, may be made the basis of such a test. For in the particular case when n=2, the natural logarithm of the probability is equal to $-\frac{1}{2}\chi^2$. If therefore we take the natural logarithm of a probability, change its sign and double it, we have the equivalent value of χ^2 for 2 degrees of freedom. Any number of such values may be added together, to give a composite test, using the Table of χ^2 to examine the significance of the result.[16]

Conclusions concerning the major hypotheses were also based on a .05 level of significance.

D - Limitations of the Study

The [illegible]ral validity of the results of this study will be li[illegible]ted by two factors:

1) The degree to which the matching process eliminated length of stay differences which were due to the patient mix, and
2) the amount of bias introduced into the sampling method by the use of the writer's judgment in the selection of the patient profiles to be compared.

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16. Sir Ronald A. Fisher, SC.D., F.R.S., Statistical Methods for Research Workers, p. 99.

The matching process was more successful among patient groups treated in military hospitals than between PAS patients and their DoD counterparts. The PAS data differed from the military data in several significant ways. The first difference involved the diagnostic codes used. As we mentioned earlier in this chapter, the PAS system utilizes the Hospital Adaptation of the International Classification of Diseases, Adapted (H-ICDA) for coding patient diagnoses; whereas military hospitals code discharge diagnoses according to the eighth edition of the International Classification of Diseases, Adapted (ICDA-8). Therefore, the PAS diagnostic codes include a broader scope of patients' diagnoses. The degree to which these variances between the diagnostic codes of the PAS and military hospitals will affect the length of stay comparisons is unknown.

A second disparity between PAS and DoD patient data was that, unlike the former, the latter were sex-specific. However, according to studies by Holmberg and James, Neuberger, and Neuberger, sex has a very insignificant relationship to length of stay.[17] Therefore, this

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17. R. Hopkins Holmberg, "The Relation of Certain Factors to Length of Inpatient Stay," p. 18; Estelle James, Egon Neuberger, and Florence Neuberger, "Hospital Length of Stay -- A Preliminary Analysis," p. 9.

matching difficulty was not considered to have affected the test results to any measurable degree.

The fact that PAS data contain Canadian patient data in addition to those from hospitals within the continental United States presented another inconsistency between the PAS and DoD data. The Canadian patients, while only 10% of the total PAS patients, did represent length of stay data from a governmentally controlled health care system which is considerably different than the private health care system in the United States. However, PAS data are more similar to DoD data in that neither Canadian nor DoD patients are required to make any significant direct payments for their health care.

Unfortunately, the data intervals for the comparisons of PAS and DoD length of stay data are fixed because of the structure of the PAS length of stay book. Therefore, if the null hypotheses for those comparisons are accepted, we will not know whether the results are valid or merely due to the obscuring of differences within broad data intervals. The importance of arraying data in a sufficient number of intervals is described as follows by Siegel:

> In the use of the Kolmogorov-Smirnov test on data for which the size and number of intervals are arbitrary, it is well to use as many intervals as are feasible. When too few intervals are used, information may be wasted. That is the maximum vertical deviation "D" of

> the two cumulative step functions may be obscured by casting the data into too few intervals.[18]

Despite the limitations delineated above, the length of stay comparisons in this study are made between more closely matched groups of patients than in any previous research. In addition, the results should provide a clear indication of the relative length of stay experiences of the total patient populations of those health care delivery systems studied.

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18. Siegel, p. 128.

III FINDINGS

The results of the tests of the hypotheses are presented in the first portion of this chapter. The presentations incorporate a four step format which includes a statement of the null form of the major hypothesis; a table which lists the results of the testing of each sub-hypothesis; an analysis of the major hypothesis; and finally, a discussion of the findings.

In the second part of the chapter, the sample length of stay data from each of the four health care delivery systems are presented graphically. The cumulative frequency distributions which are plotted in the graphs consist of a maximum of eight data points, but should provide the reader with a fairly accurate picture of each health care system's length of stay experience. The four systems' length of stay performances for a particular patient profile are incorporated into a single graph to facilitate comparisons by the reader.

A - RESULTS OF TESTS OF HYPOTHESES

Hypothesis 1:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 11

Sub-hypotheses	Primary Diagnosis	Army N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
1(a)	009.2	497	14,410	0.000	reject H_o	939.88
1(b)	250.9	51	3,843	0.024	reject H_o	8.54
1(c)	412.9	6	3,029	**	**	**
1(d)	455.0	243	9,488	0.000	reject H_o	72.92
1(e)	465.0	491	2,834	0.000	reject H_o	253.21
1(f)	486.0	498	8,313	0.000	reject H_o	229.05
1(g)	493.0	165	11,135	0.000	reject H_o	82.89
1(h)	500.0	13	230.060	0.000	reject H_o	33.66
1(i)	550.0	498	16,022	0.000	reject H_o	221.82
1(j)	650.0	20	31,850	0.315	accept H_o	2.31

Composite X^2 Value = 1844.28

*N = Sample size

**Sample size too small for valid comparison to be made.

Step 3: Analysis of Major Hypothesis 1:

1. Composite $X^2 = 1844.28$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 28.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 28.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 28.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 11 reveals that there is a significant difference between the lengths of stay experienced by active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in PAS hospitals. The composite X^2 value is extremely large and indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

Hypothesis 2:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 12

Sub-hypotheses	Primary Diagnosis	Army N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
2(a)	009.2	38	14,410	0.000	reject H_o	55.16
2(b)	250.9	23	3,843	0.010	reject H_o	9.21
2(c)	412.9	24	3,029	0.163	accept H_o	3.63
2(d)	455.0	10	9,488	0.327	accept H_o	2.24
2(e)	465.0	87	2,834	0.000	reject H_o	61.02
2(f)	486.0	99	8,313	0.000	reject H_o	67.50
2(g)	493.0	229	11,135	0.000	reject H_o	121.38
2(h)	500.0	499	230,060	0.001	reject H_o	14.77
2(i)	550.0	253	16,022	0.035	reject H_o	6.70
2(j)	650.0	498	31,850	0.000	reject H_o	613.65

Composite X^2 Value = 955.26

*N = Sample size

Step 3: Analysis of Major Hypothesis 2:

1. Composite $X^2 = 955.26$

   Degrees of freedom = 20

   α significance level = .05

2. $X^2_{.05;20} = 31.41$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;20} = 31.41$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;20} = 31.41$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 12 reveals that there is a significant difference between the lengths of stay experienced by non-active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in PAS hospitals. The composite X^2 value is very large and indicates a small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

Hypothesis 3:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Naval hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 13

Sub-hypothesis	Primary Diagnosis	Navy N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
3(a)	009.2	223	14,410	0.000	reject H_o	118.72
3(b)	250.9	115	3,843	0.000	reject H_o	124.05
3(c)	412.9	36	3,029	0.000	reject H_o	44.85
3(d)	455.0	186	9,488	0.000	reject H_o	261.05
3(e)	465.0	355	2,834	0.000	reject H_o	39.57
3(f)	486.0	500	8,313	0.000	reject H_o	73.96
3(g)	493.0	92	11,135	0.000	reject H_o	93.48
3(h)	500.0	20	230,060	0.000	reject H_o	63.26
3(i)	550.0	501	16,022	0.000	reject H_o	770.34
3(j)	650.0	22	31,850	0.000	reject H_o	92.32

Composite X^2 Value = 1681.60

*N = Sample size

Step 3: Analysis of Major Hypothesis 3:

1. Composite $X^2 = 1681.60$

   Degrees of freedom = 20

   α significance level = .05

2. $X^2_{.05;20} = 31.41$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;20} = 31.41$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;20} = 31.41$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 13 reveals that there is a significant difference in the lengths of stay experienced by active duty military patients treated in Naval hospitals and the lengths of stay of comparable patients treated in PAS hospitals. The composite X^2 value is extremely large and indicates a very small probability of a Type I error.* Consequently, the null hypothesis is rejected and the alternative, in this case the working hypothesis, is accepted.

*Type I error occurs when one rejects H_o when it is, in fact, true.

Hypothesis 4:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Naval hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 14

Sub-hypothesis	Primary Diagnosis	Navy N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
4(a)	009.2	9	14,410	0.678	accept H_o	0.78
4(b)	250.9	92	3,843	0.035	reject H_o	6.70
4(c)	412.9	53	3,029	0.013	reject H_o	8.69
4(d)	455.0	8	9,488	0.995	accept H_o	0.01
4(e)	465.0	2	2,834	**	**	**
4(f)	486.0	8	8,313	**	**	**
4(g)	493.0	364	11,135	0.000	reject H_o	523.02
4(h)	500.0	501	230,060	0.003	reject H_o	10.00
4(i)	550.0	49	16,022	0.002	reject H_o	12.00
4(j)	650.0	501	31,850	0.000	reject H_o	552.75

Composite X^2 Value = 1113.95

*N = Sample size

**Sample size to small for valid comparison to be made.

Step 3: Analysis of Major Hypothesis 4:

1. Composite $X^2 = 1113.95$

   Degrees of freedom = 16

   α significance level = .05

2. $X^2_{.05;16} = 26.296$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;16} = 26.296$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;16} = 26.296$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 14 reveals that there is a significant difference in the lengths of stay experienced by non-active duty military patients hospitalized in Naval hospitals and the lengths of stay of comparable patients hospitalized in PAS hospitals. The composite X^2 value is extremely large and indicates a very small probability of committing a Type I error. The acceptance of the null hypothesis for two of the sub-hypotheses may be more a function of the small sample size than of the comparability of the distributions of the lengths of stay. Despite the acceptance of the null form of two sub-hypotheses, the null form of the major hypothesis is rejected in favor of the alternative hypothesis.

Hypothesis 5:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 15

Sub-hypothesis	Primary Diagnosis	USAF N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
5(a)	009.2	501	14,410	0.000	reject H_o	1269.26
5(b)	250.9	51	3,843	0.051	accept H_o	5.80
5(c)	412.9	14	3,029	0.222	accept H_o	3.01
5(d)	455.0	180	9,488	0.000	reject H_o	42.70
5(e)	465.0	497	2,834	0.000	reject H_o	217.80
5(f)	486.0	191	8,313	0.000	reject H_o	118.30
5(g)	493.0	27	11,135	0.000	reject H_o	101.80
5(h)	500.0	16	230,060	0.000	reject H_o	25.65
5(i)	550.0	501	16,022	0.000	reject H_o	76.41
5(j)	650.0	45	31,850	0.149	accept H_o	3.81

Composite X^2 Value = 1864.54

*N = Sample size

Step 3: Analysis of Major Hypothesis 5:

1. Composite $X^2 = 1864.54$

   Degrees of freedom = 20

   α significance level = .05

2. $X^2_{.05;20} = 31.41$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;20} = 31.41$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;20} = 31.41$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 15 reveals that there is a significant difference in the lengths of stay experienced by active duty military patients hospitalized in Air Force hospitals and the lengths of stay of comparable patients treated in PAS hospitals. The extremely large composite X^2 value indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

Hypothesis 6:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 16

Sub-hypothesis	Primary Diagnosis	USAF N*	PAS N*	Probability Value	Result	Equivalent X^2 Value
6(a)	009.2	40	14,410	0.000	reject H_o	72.23
6(b)	250.9	42	3,843	0.000	reject H_o	32.25
6(c)	412.9	8	3,029	0.994	accept H_o	0.01
6(d)	455.0	5	9,488	**	**	**
6(e)	465.0	38	2,834	0.000	reject H_o	16.93
6(f)	486.0	38	8,313	0.001	reject H_o	14.10
6(g)	493.0	501	11,135	0.000	reject H_o	760.37
6(h)	500.0	501	230,060	0.055	accept H_o	5.83
6(i)	550.0	69	16,022	0.000	reject H_o	36.31
6(j)	650.0	501	31,850	0.000	reject H_o	121.82

Composite X^2 Value = 1059.85

*N = Sample size

**Sample size too small for valid comparison to be made.

Step 3: Analysis of Major Hypothesis 6:

1. Composite $X^2 = 1059.85$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 28.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 28.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 28.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 16 reveals that there is a significant difference in the lengths of stay experienced by non-active duty military patients hospitalized in Air Force hospitals and the lengths of stay of comparable patients treated in PAS hospitals. The extremely large composite X^2 value indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

Hypothesis 7:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 17

Sub-hypotheses	Primary Diagnosis	Army N*	Navy N*	Probability Value	Result	Equivalent X^2 Value
7(a)	009.2	501	223	0.000	reject H_o	15.10
7(b)	250.9	51	115	0.000	reject H_o	12.00
7(c)	412.9	6	36	**	**	**
7(d)	455.0	243	186	0.000	reject H_o	24.22
7(e)	465.0	501	355	0.000	reject H_o	13.44
7(f)	486.0	498	500	0.000	reject H_o	21.08
7(g)	493.0	165	92	0.000	reject H_o	36.31
7(h)	500.0	13	20	0.142	accept H_o	3.90
7(i)	550.0	498	501	0.000	reject H_o	101.03
7(j)	650.0	20	22	0.155	accept H_o	3.73

Composite X^2 Value = 230.81

*N = Sample size

**Sample size too small for valid comparisons to be made.

Step 3: Analysis of Major Hypothesis 7:

1. Composite $X^2 = 230.81$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 28.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 28.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 28.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 17 reveals that there is a significant difference between the lengths of stay experienced by active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in Naval hospitals. The large composite X^2 value indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected, and the alternative, or working hypothesis, is accepted.

Hypothesis 8:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 18

Sub-hypotheses	Primary Diagnosis	Army N*	Navy N*	Probability Value	Result	Equivalent X^2 Value
8(a)	009.2	38	9	0.047	reject H_o	6.16
8(b)	250.9	23	92	0.136	accept H_o	3.99
8(c)	412.9	24	53	0.123	accept H_o	4.19
8(d)	455.0	10	8	0.995	accept H_o	0.01
8(e)	465.0	87	2	**	**	**
8(f)	486.0	99	8	0.022	reject H_o	7.63
8(g)	493.0	229	364	0.000	reject H_o	279.51
8(h)	500.0	499	501	0.005	reject H_o	10.00
8(i)	550.0	253	49	0.075	accept H_o	5.18
8(j)	650.0	498	501	0.000	reject H_o	166.58

Composite X^2 Value = 483.25

*N = Sample size

**Sample size too small for valid comparison to be made.

Step 3: Analysis of Major Hypothesis 8:

1. Composite $X^2 = 483.25$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 26.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 26.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 26.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 18 reveals that there is a difference between the lengths of stay of non-active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in Naval hospitals. The composite X^2 value, while not overwhelmingly large, was large enough to result in the rejection of the null hypothesis and the acceptance of the alternative, or working hypothesis. However, the acceptance of four of the nine null forms of the sub-hypotheses would seem to indicate that the lengths of stay for many diagnoses may be very similar for non-active duty patients treated in Army and Naval hospitals.

Hypothesis 9:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Air force hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 19

Sub-hypotheses	Primary Diagnosis	Army N*	USAF N*	Probability Value	Result	Equivalent X^2 Value
9(a)	009.2	497	501	0.000	reject H_o	11.13
9(b)	250.9	51	51	0.610	accept H_o	0.99
9(c)	412.9	6	14	**	**	**
9(d)	455.0	243	180	0.801	accept H_o	0.44
9(e)	465.0	491	497	0.070	accept H_o	5.32
9(f)	486.0	498	191	0.031	reject H_o	6.95
9(g)	493.0	165	27	0.007	reject H_o	10.00
9(h)	500.0	13	16	0.984	accept H_o	0.03
9(i)	550.0	498	501	0.000	reject H_o	21.08
9(j)	650.0	20	45	0.930	accept H_o	2.08

Composite X^2 Value = 58.02

*N = Sample size

**Sample size too small for valid comparison to be made.

Step 3: Analysis of Major Hypothesis 9:

1. Composite $X^2 = 58.02$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 26.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 26.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 26.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 19 reveals that there is a difference between the lengths of stay of active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in Air Force hospitals. The composite X^2 value, while not extremely large, was sufficient to reject the null hypothesis and accept the alternative, or working hypothesis. However, the acceptance of five of nine sub-hypotheses may indicate that the lengths of stay for many diagnostic groups may be very similar for active duty military patients treated in Army and Air Force hospitals.

Hypothesis 10:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Air Force hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 20

Sub-hypotheses	Primary Diagnosis	Army N*	USAF N*	Probability Value	Result	Equivalent X^2 Value
10(a)	009.2	497	501	0.014	reject H_o	8.54
10(b)	250.9	23	42	0.776	accept H_o	0.51
10(c)	412.9	24	8	0.851	accept H_o	0.32
10(d)	455.0	10	5	**	**	**
10(e)	465.0	87	38	0.000	reject H_o	38.05
10(f)	486.0	99	38	0.000	reject H_o	21.85
10(g)	493.0	229	501	0.000	reject H_o	339.39
10(h)	500.0	499	501	0.084	accept H_o	4.95
10(i)	550.0	253	69	0.004	reject H_o	10.00
10(j)	650.0	498	501	0.000	reject H_o	101.03

Composite X^2 Value = 524.64

*N = Sample size

**Sample size too small for valid comparison to be made

Step 3: Analysis of Major Hypothesis 10:

1. Composite $X^2 = 524.64$

   Degrees of freedom = 18

   α significance level = .05

2. $X^2_{.05;18} = 26.87$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;18} = 26.87$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;18} = 26.87$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 20 reveals that there is a significant difference between the lengths of stay experienced by non-active duty military patients hospitalized in Army hospitals and the lengths of stay of comparable patients hospitalized in Air Force hospitals. The large composite X^2 value indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected, and the alternative, or working hypothesis, is accepted.

Hypothesis 11:

Step 1: H_o:

Active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 21

Sub-hypothesis	Primary Diagnosis	USAF N*	Navy N*	Probability Value	Result	Equivalent X^2 Value
11(a)	009.2	501	223	0.000	reject H_o	140.70
11(b)	250.9	51	115	0.000	reject H_o	33.90
11(c)	412.9	14	36	0.000	reject H_o	23.80
11(d)	455.0	180	186	0.000	reject H_o	79.97
11(e)	465.0	497	355	0.000	reject H_o	43.77
11(f)	486.0	191	500	0.000	reject H_o	23.40
11(g)	493.0	27	92	0.000	reject H_o	18.93
11(h)	500.0	16	20	0.136	accept H_o	3.99
11(i)	550.0	501	501	0.000	reject H_o	194.70
11(j)	650.0	45	22	0.421	accept H_o	1.73
					Composite X^2 Value =	564.89

*N = Sample size

Step 3: Analysis of Hypothesis 11:

1. Composite $X^2 = 564.89$

   Degrees of freedom = 20

   α significance level = .05

2. $X^2_{.05;20} = 31.41$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;20} = 31.41$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;20} = 31.41$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 21 reveals that there is a significant difference in the lengths of stay experienced by active duty military patients hospitalized in Air Force hospitals and the lengths of stay of comparable patients hospitalized in Naval hospitals. The large composite X^2 value indicates a very small probability of committing a Type I error. Consequently, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

Hypothesis 12:

Step 1: H_o:

Non-active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as non-active duty military patients who are matched in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.

Step 2:

SUMMARY OF TESTS OF SUB-HYPOTHESES

Table 22

Sub-hypothesis	Primary Diagnosis	USAF N*	Navy N*	Probability Value	Result	Equivalent X^2 Value
12(a)	009.2	40	9	0.038	reject H_o	6.54
12(b)	250.9	42	92	0.002	reject H_o	16.40
12(c)	412.9	8	53	0.999	accept H_o	0.00
12(d)	455.0	5	8	**	**	**
12(e)	465.0	38	2	**	**	**
12(f)	486.0	38	8	0.194	accept H_o	3.28
12(g)	493.0	501	364	0.987	accept H_o	0.03
12(h)	500.0	501	501	0.996	accept H_o	0.01
12(i)	550.0	69	49	0.003	reject H_o	12.00
12(j)	650.0	501	501	0.000	reject H_o	84.73

Composite X^2 Value = 122.99

*N = Sample size

**Sample size too small for valid comparisons to be made.

Step 3: Analysis of Major Hypothesis 12:

1. Composite $X^2 = 122.99$

   Degrees of freedom = 16

   α significance level = .05

2. $X^2_{.05;16} = 26.296$

3. Reject the null hypothesis if

   $X^2 \geq X^2_{.05;16} = 26.296$

   Accept the null hypothesis if

   $X^2 < X^2_{.05;16} = 26.296$

4. Therefore, the null hypothesis is rejected at the .05 level of significance.

Step 4: Findings:

The analysis of the data in Table 22 reveals that there is a significant difference in the lengths of stay experienced by non-active duty military patients hospitalized in Air Force hospitals and the lengths of stay of comparable patients hospitalized in Navy hospitals. Although the composite X^2 value is not extremely large, the probability of committing a Type I error is still quite small. Therefore, the null form of the major hypothesis is rejected and the alternative, or working hypothesis, is accepted.

B - GRAPHIC PRESENTATIONS OF PAS, ARMY, NAVY, AND AIR FORCE LENGTH OF STAY DATA

PAS, ARMY, NAVY, AND AIR FORCE AVERAGE LENGTHS OF STAY FOR TEN SELECTED DIAGNOSES

Table 23

Average Length of Stay (Days)

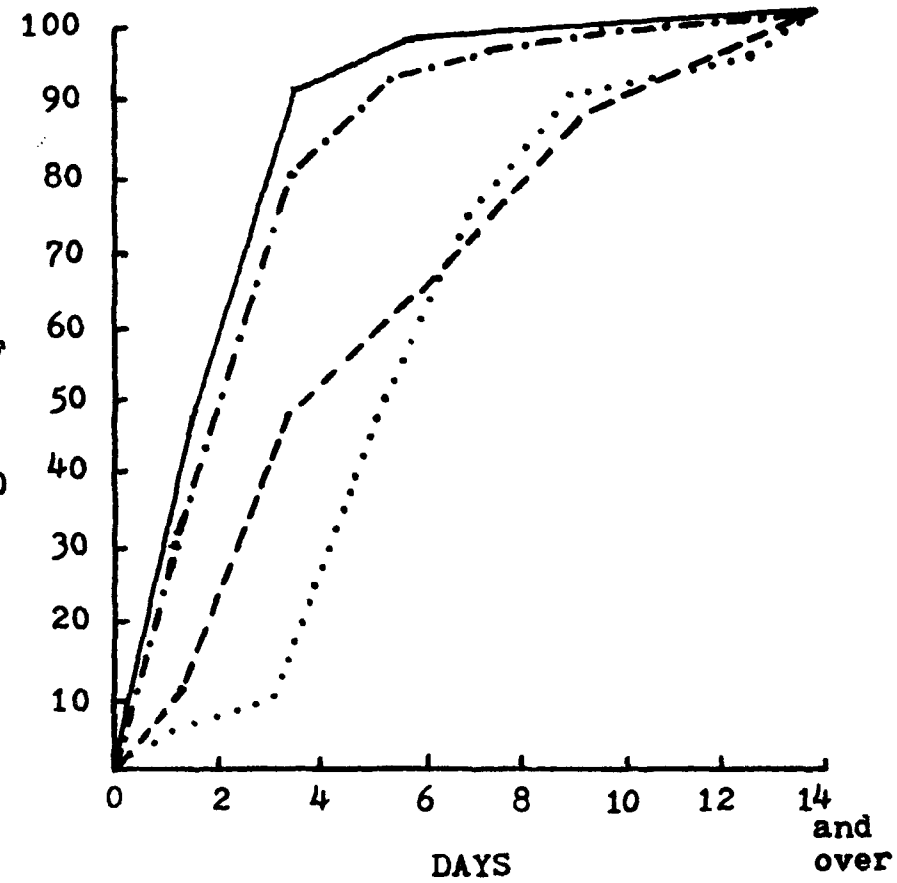
Primary Diagnosis	PAS	Army		Navy		Air Force	
		AD	Non-AD	AD	Non-AD	AD	Non-AD
009.2	3.5	2.7	3.0	6.5	16.0*	1.9	2.9
250.9	7.8	21.7	6.7	30.8	11.2	8.1	6.1
412.9	7.6	7.7*	7.5	48.8	10.7	4.9	13.9*
455.0	6.0	7.3	6.5*	18.2	7.9*	7.8	11.6*
465.0	3.8	2.8	3.4	4.3	2.0*	3.2	3.0
486.0	6.5	5.4	5.5	12.5	8.0*	6.4	6.0
493.0	4.3	9.3	8.8	23.5	3.2	5.3	3.1
500.0	1.8	4.4*	2.7	7.2	2.1	5.1*	2.1
550.0	5.1	8.2	4.1	14.9	8.9	6.6	4.6
650.0	3.6	4.2	3.4	10.2	3.8	5.1	4.0

*Sample size less than 20

- GASTROENTERITIS AND COLITIS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 24

Profile:
- Primary Diagnosis: 009.2
- Without Surgery
- Active Duty
- Age: 20-34
- Sex: Male



PAS = ...

ARMY = -.-.

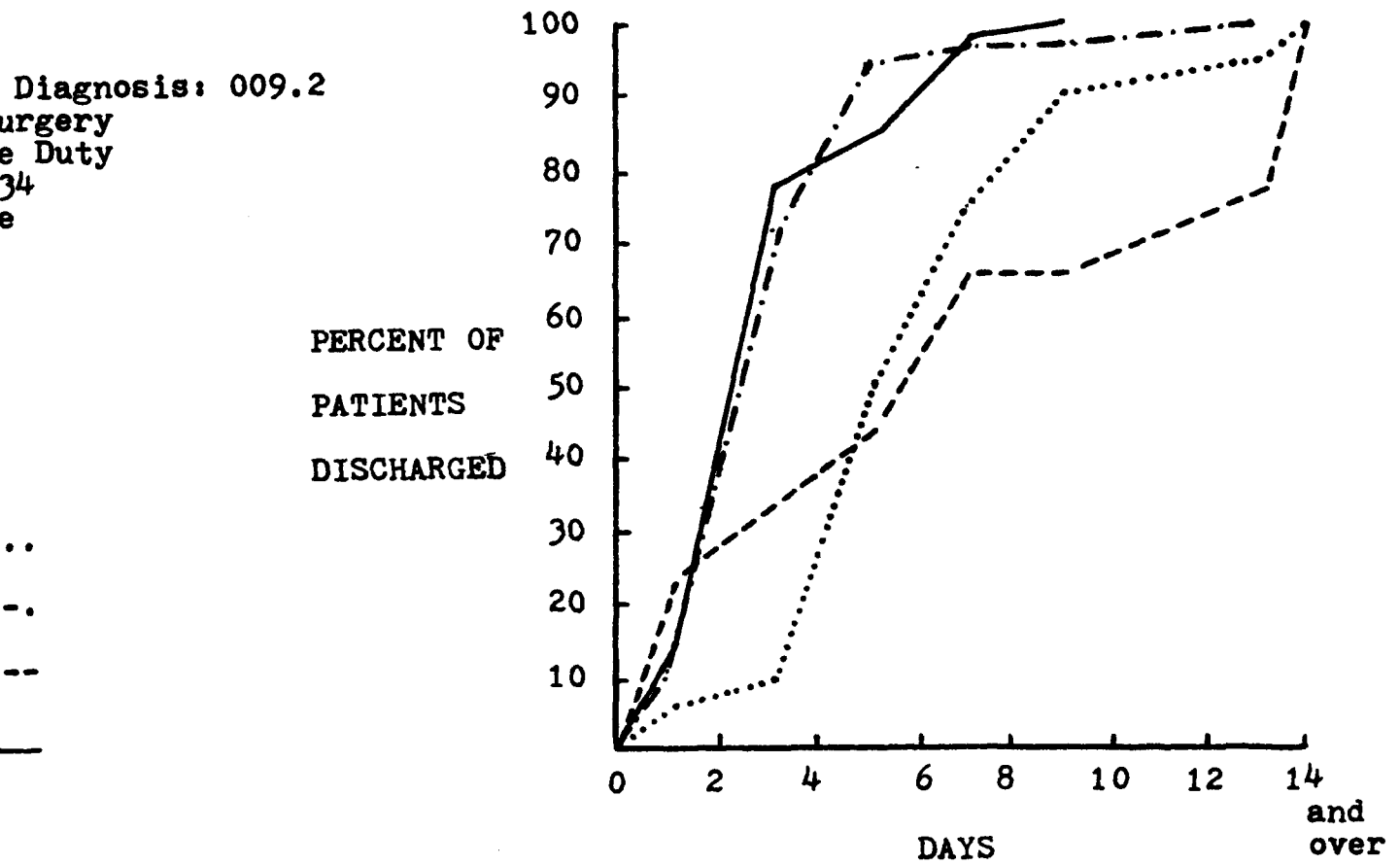
NAVY = ----

USAF = ____

- GASTROENTERITIS AND COLITIS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY;
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 25

Profile
Primary Diagnosis: 009.2
Without Surgery
Non-Active Duty
Age: 20-34
Sex: Male



PAS = ...

ARMY = -.-.

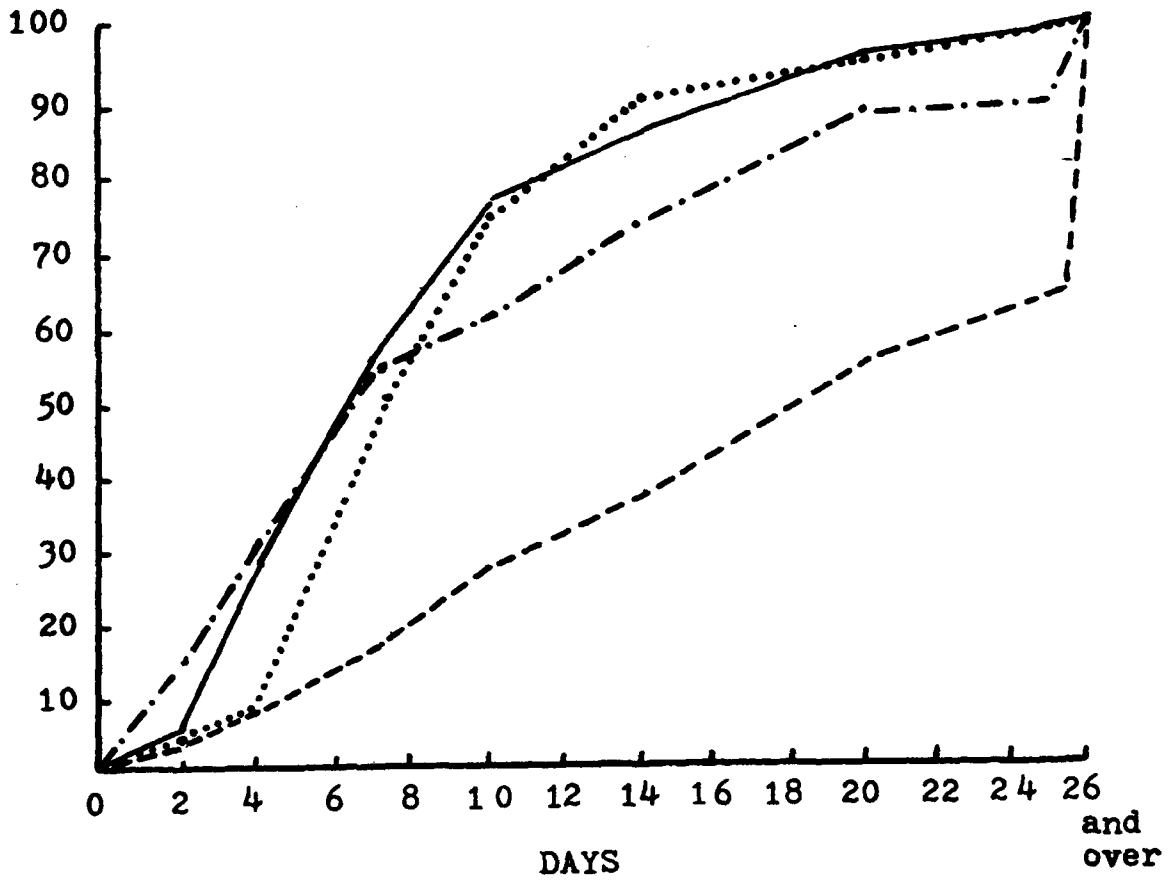
NAVY = ----

USAF = ____

- DIABETES MELLITUS WITHOUT ACIDOSIS OR COMA - PERCENTAGE OF PATIENTS DISCHARGED BY DAY: A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 26

Profile:
Primary Diagnosis: 250.9
Single Diagnosis
Without Surgery
Active Duty
Age: 35-49
Sex: Male



PAS = ...

ARMY = -.-.

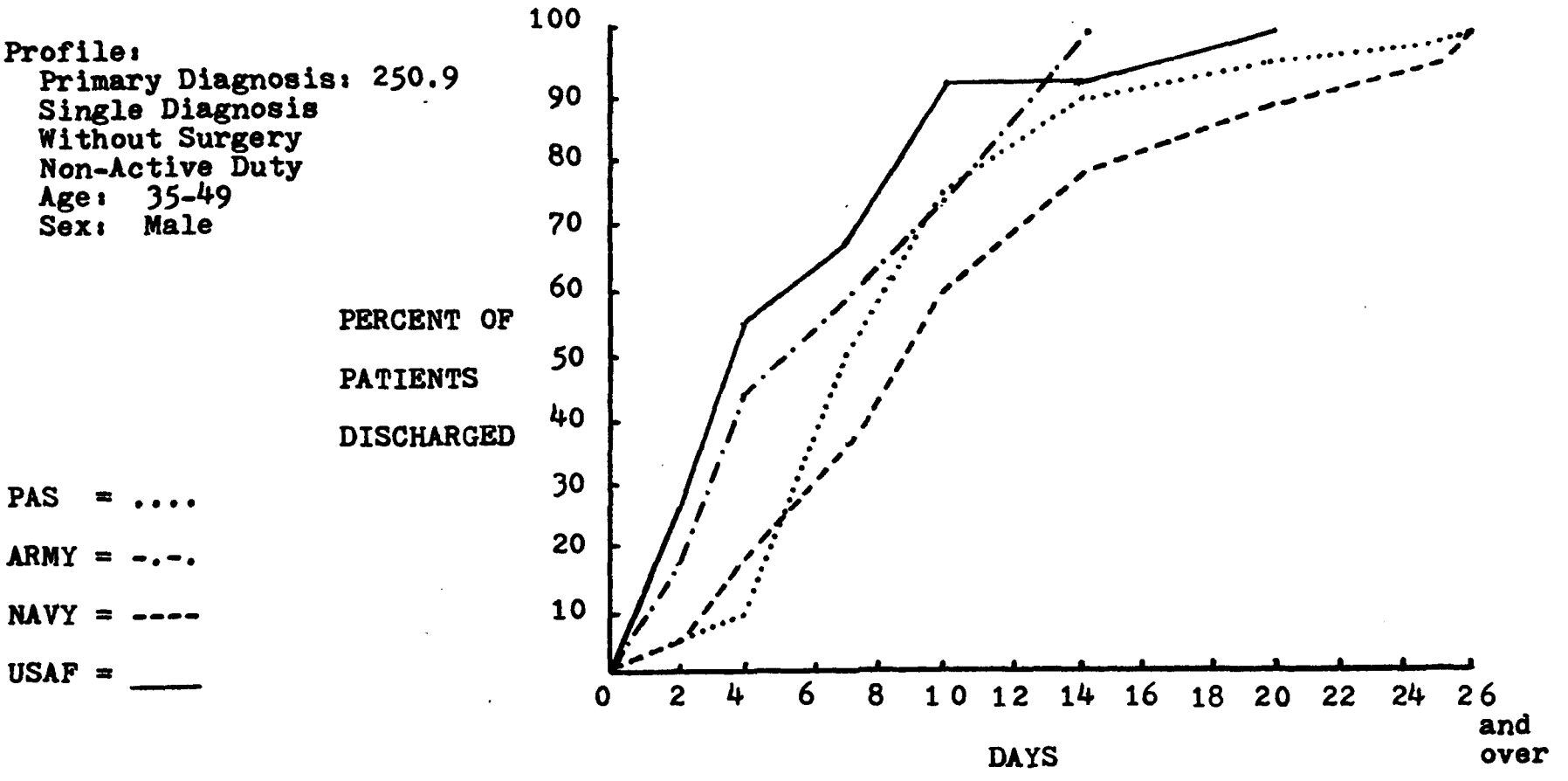
NAVY = ----

USAF = ____

- DIABETES MELLITUS WITHOUT ACIDOSIS OR COMA -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

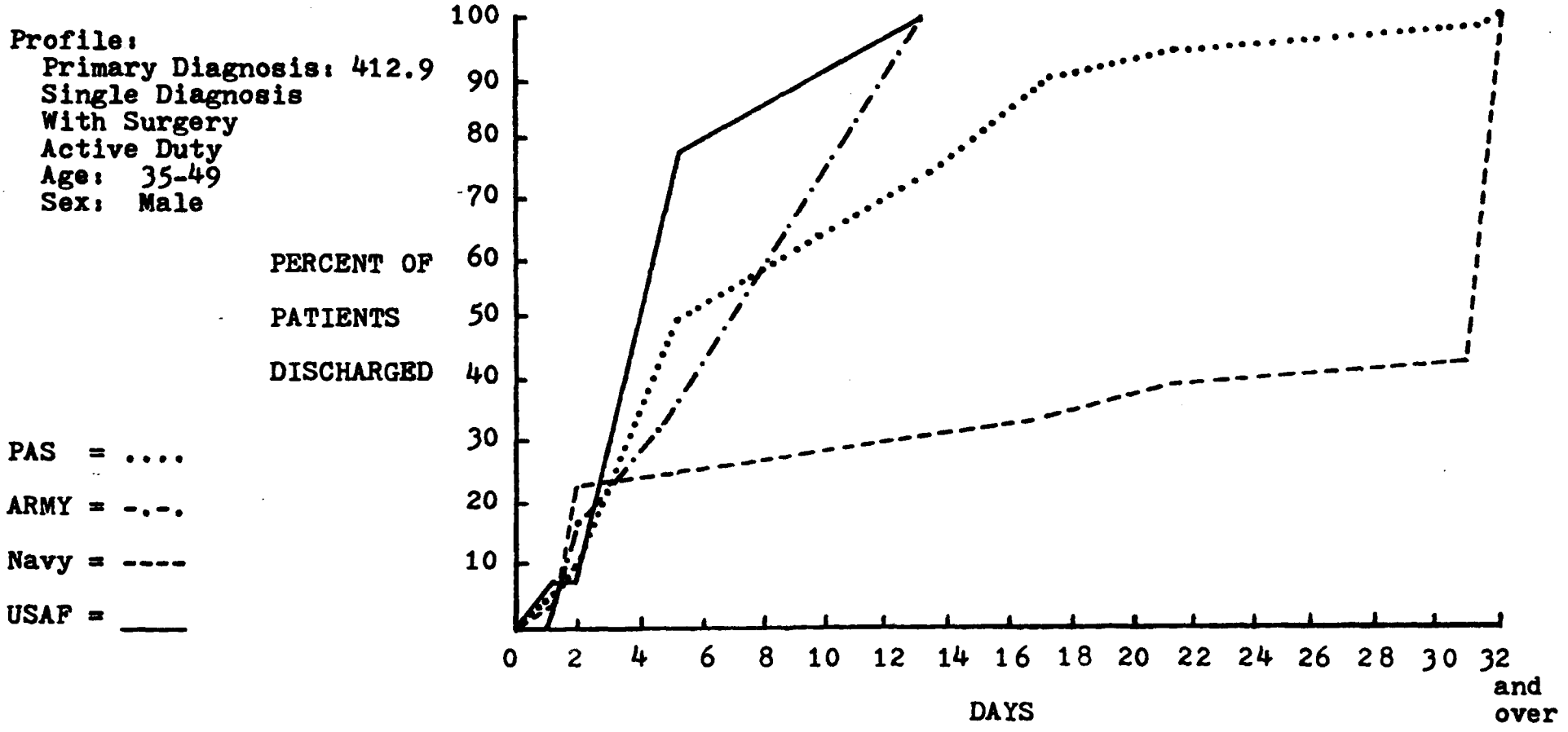
Table 27

Profile:
Primary Diagnosis: 250.9
Single Diagnosis
Without Surgery
Non-Active Duty
Age: 35-49
Sex: Male



- CHRONIC ISCHEMIC HEART DISEASE WITHOUT HYPERTENSION -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY;
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

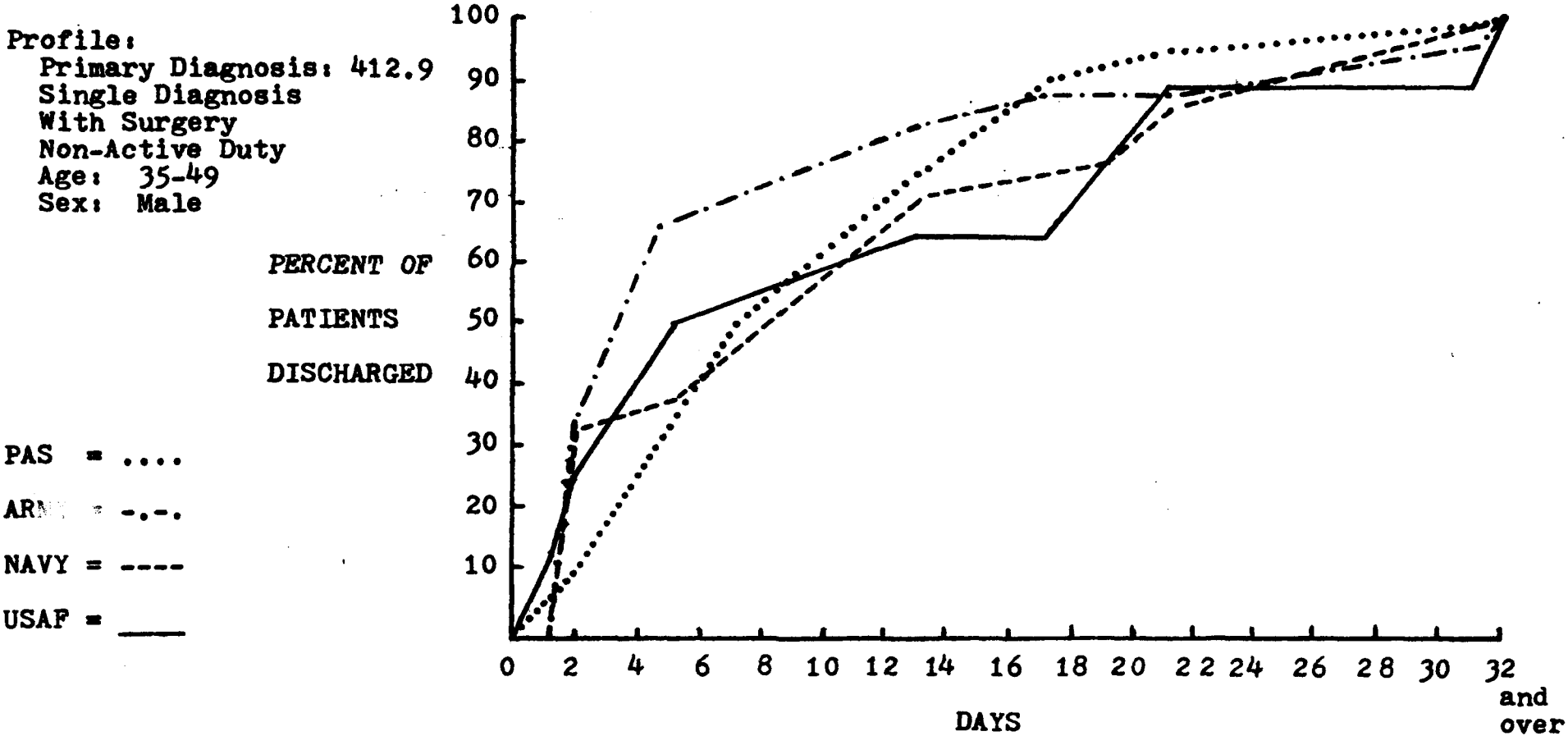
Table 28



- CHRONIC ISCHEMIC HEART DISEASE WITHOUT HYPERTENSION -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY;
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 29

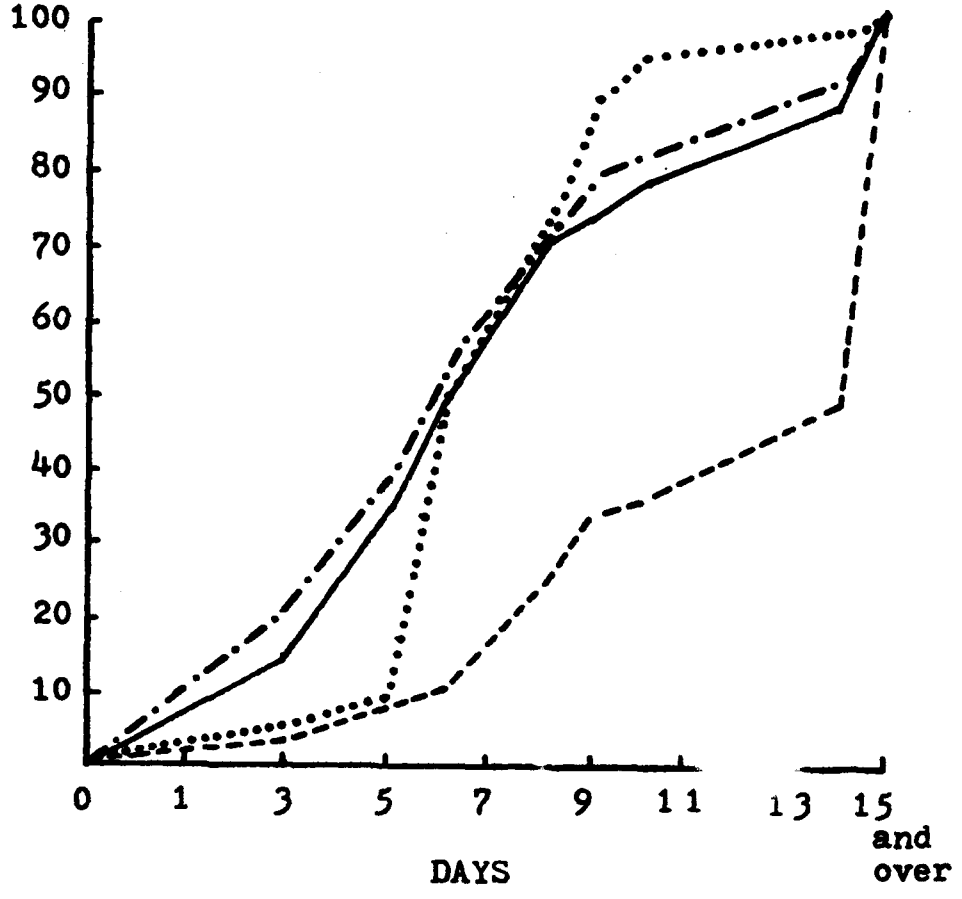
Profile:
Primary Diagnosis: 412.9
Single Diagnosis
With Surgery
Non-Active Duty
Age: 35-49
Sex: Male



- HEMORRHOIDS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 30

Profile:
Primary Diagnosis: 455.0
Single Diagnosis
With Surgery
Active Duty
Age: 20-34
Sex: Male



PAS = ...

ARMY = -.-.

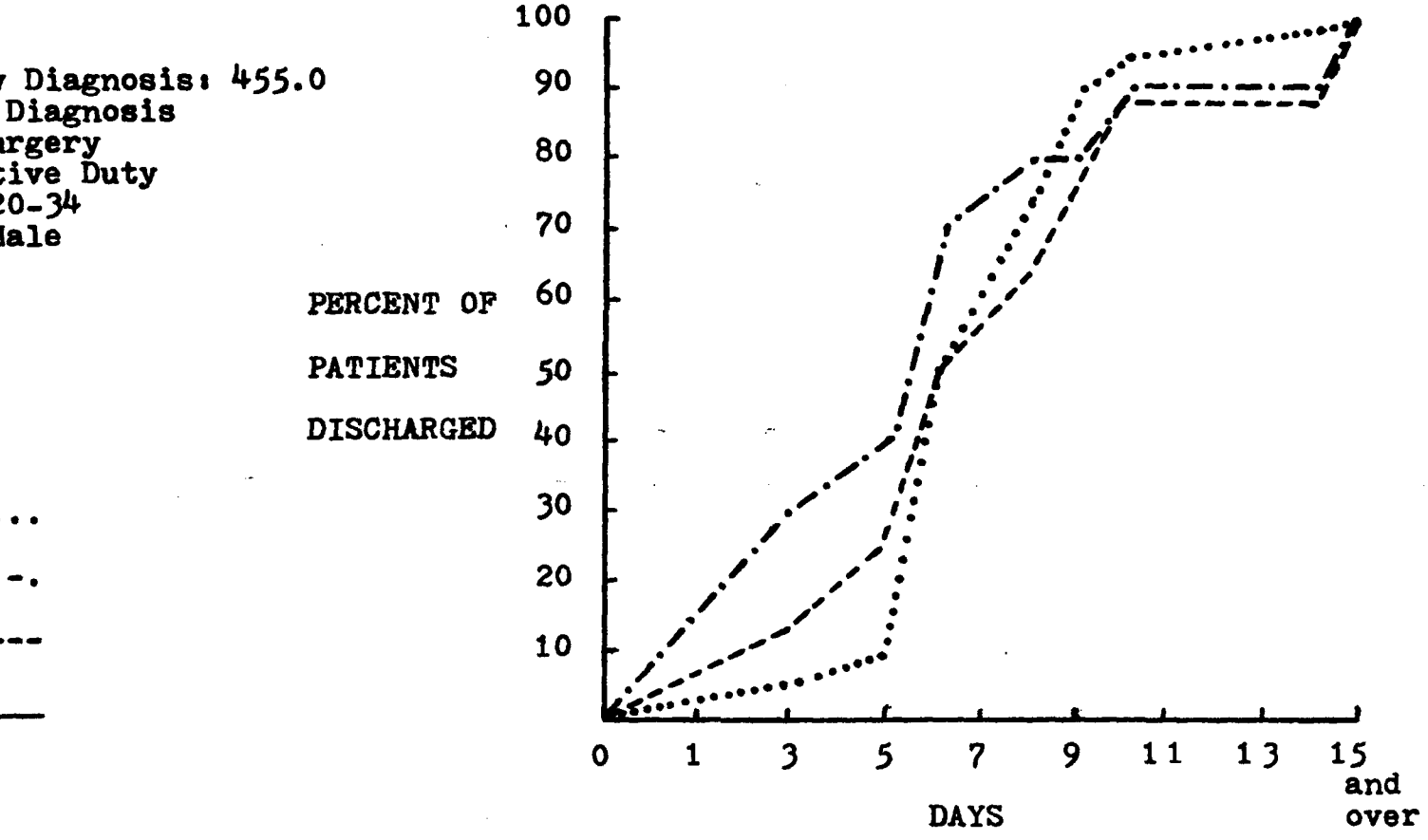
NAVY = ----

USAF = ____

- HEMORRHOIDS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 31

Profile:
Primary Diagnosis: 455.0
Single Diagnosis
With Surgery
Non-Active Duty
Age: 20-34
Sex: Male



PAS = ...

ARMY = -.-.

NAVY = ----

*USAF = ____

*Sample size too small to be meaningful.

- ACUTE UPPER RESPIRATORY INFECTION, EXCEPT BRONCHITIS - PERCENTAGE OF PATIENTS DISCHARGED BY DAY: A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 32

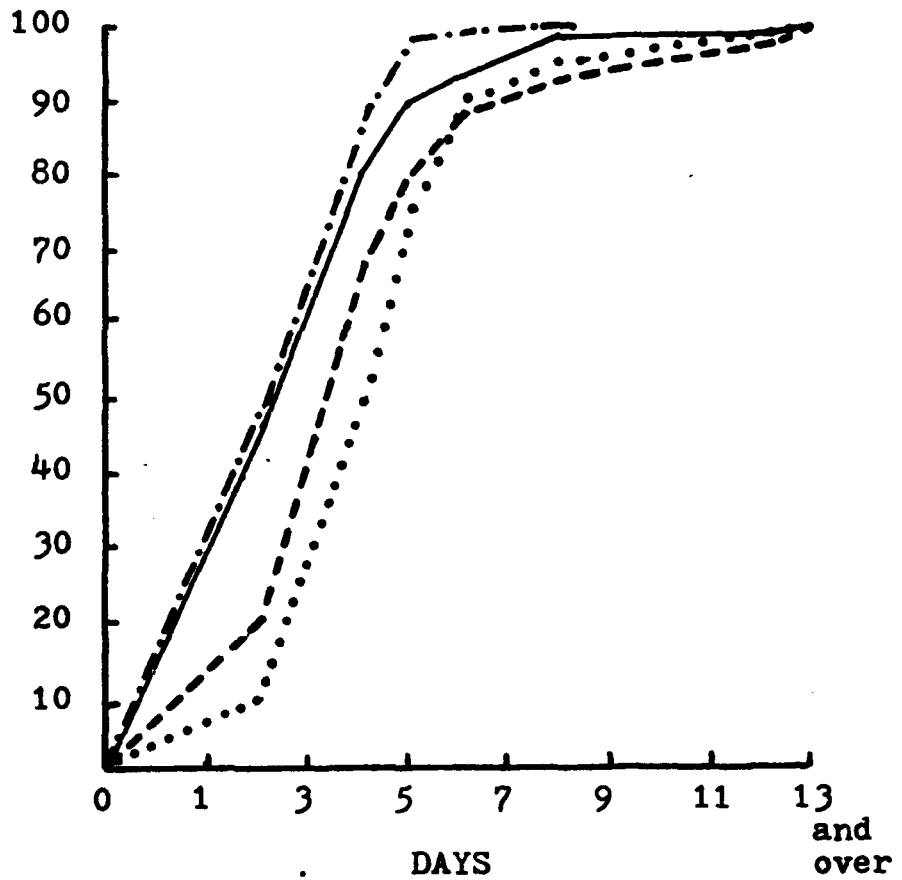
Profile:
Primary Diagnosis: 465.0
Single Diagnosis
Without Surgery
Active Duty
Age: 20-34
Sex: Male

PAS = ...

ARMY = -.-.

NAVY = ----

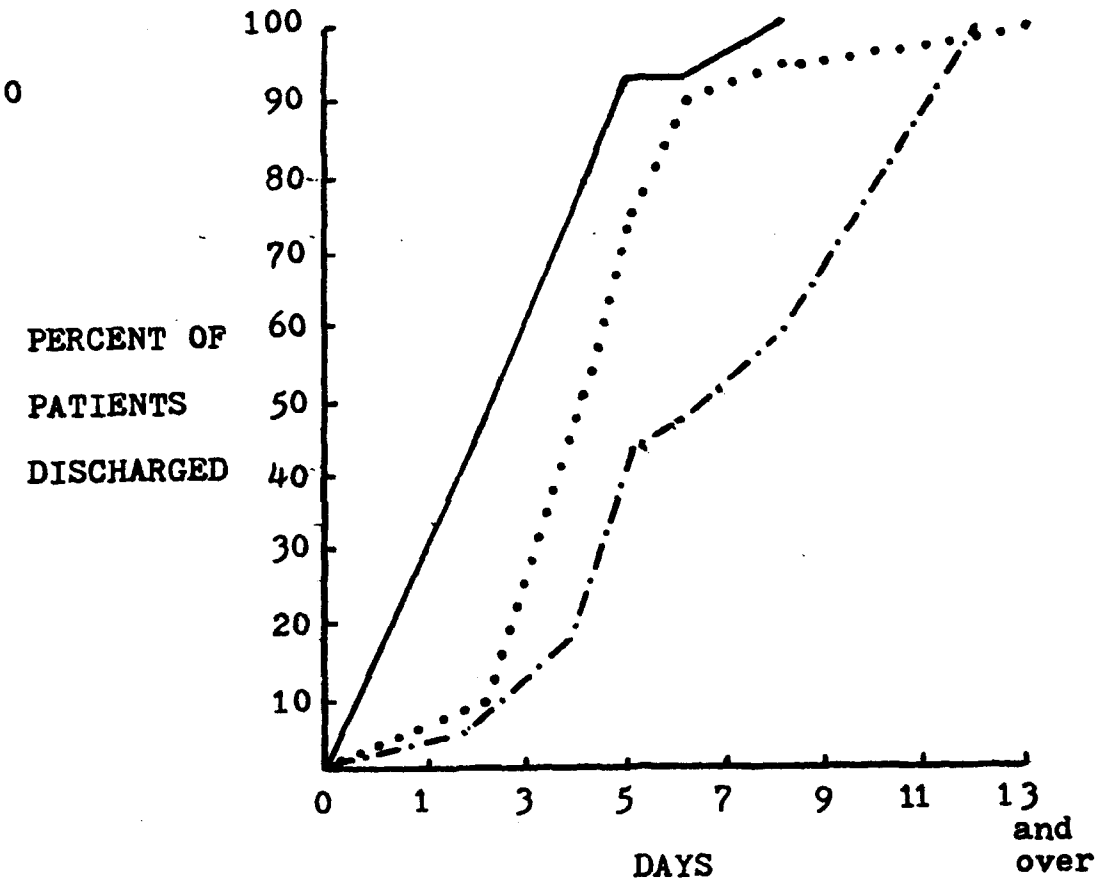
USAF = ____



- ACUTE UPPER RESPIRATORY INFECTION, EXCEPT BRONCHITIS - PERCENTAGE OF PATIENTS DISCHARGED BY DAY; A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 33

Profile:
Primary Diagnosis: 465.0
Single Diagnosis
Without Surgery
Non-Active Duty
Age: 20-34
Sex: Male



PAS = ...

ARMY = -.-.

*NAVY = ----

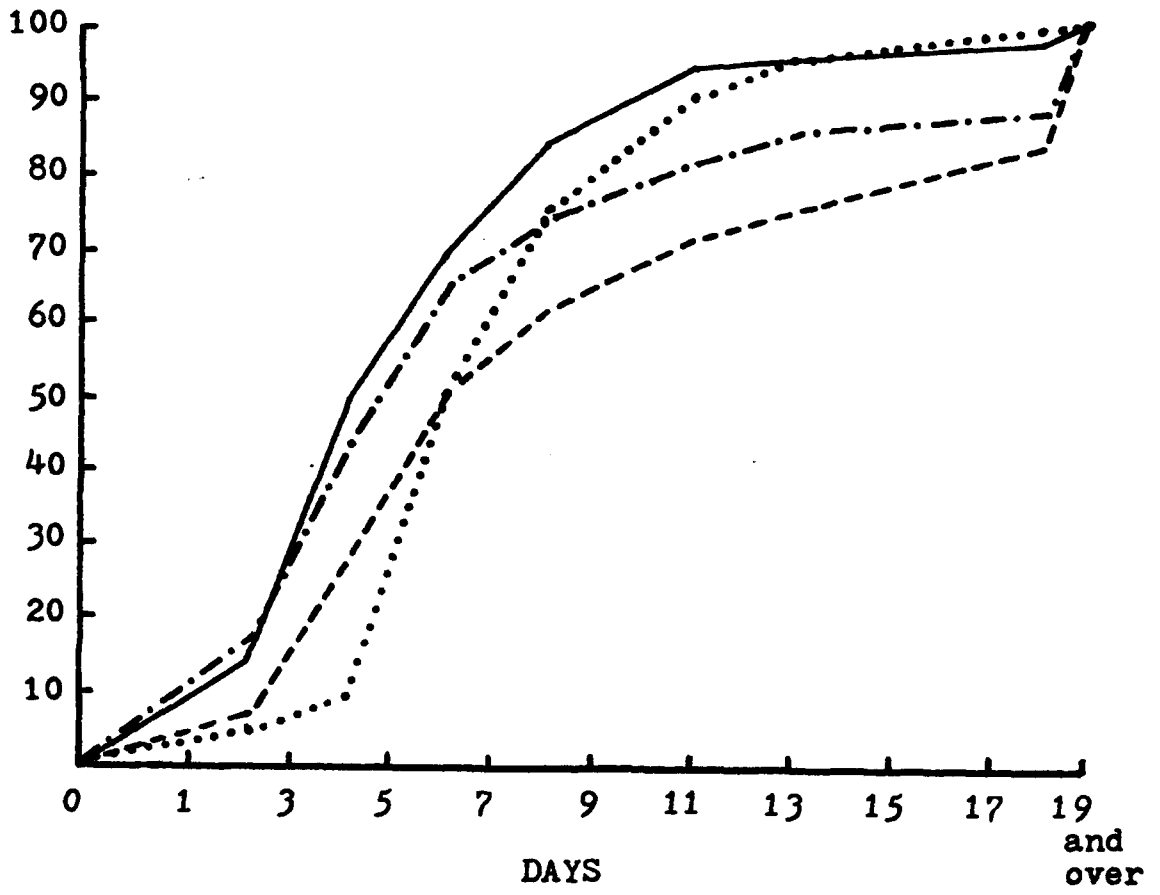
USAF = ____

*Sample size too small to be meaningful.

- PNEUMONIA, EXCEPT VIRAL -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 34

Profile:
Primary Diagnosis: 486.0
Single Diagnosis
Without Surgery
Active Duty
Age: 20-34
Sex: Male

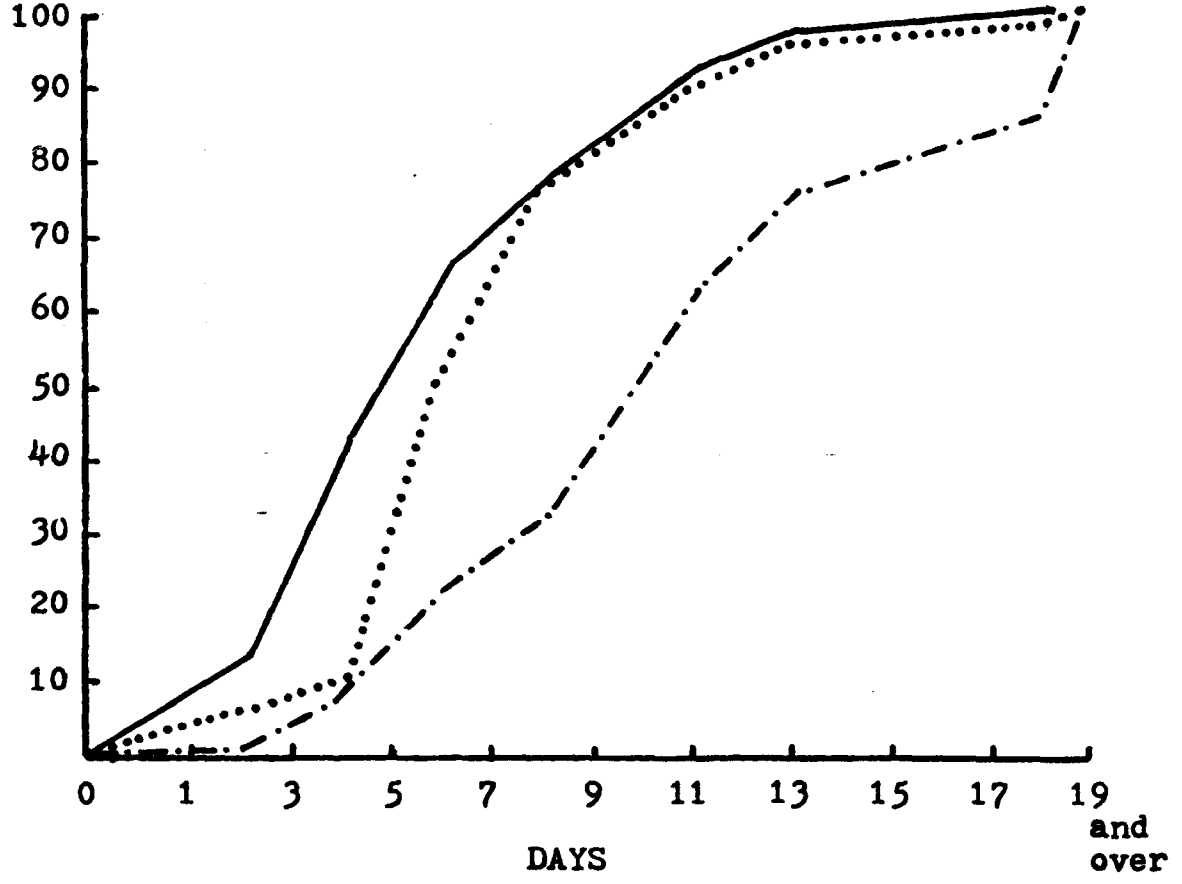


PAS = ...
ARMY = -.-.
NAVY = ----
USAF = ____

- PNEUMONIA, EXCEPT VIRAL
PERCENTAGE OF PATIENTS DISCHARGED BY DAY;
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 35

Profile:
Primary Diagnosis: 486.0
Single Diagnosis
Without Surgery
Non-Active Duty
Age: 20-34
Sex: Male



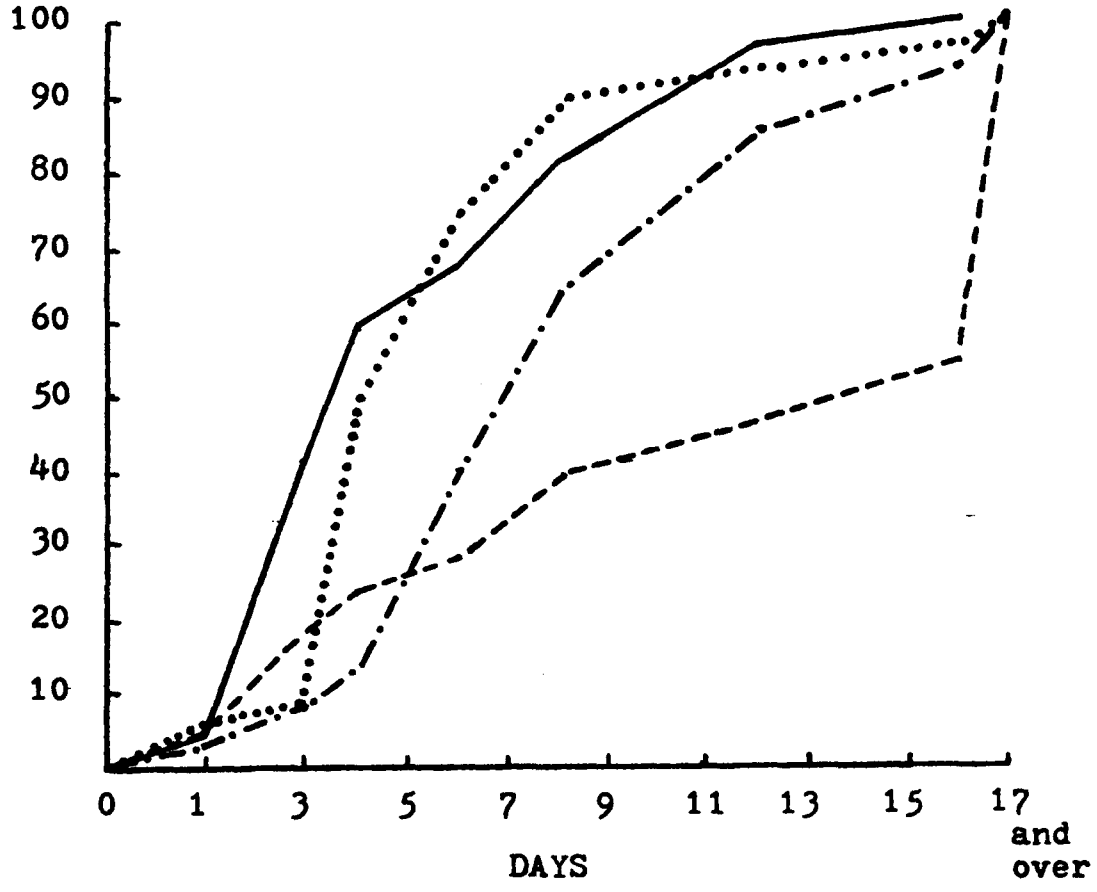
PAS = ...
ARMY = -.-.
*NAVY = ----
USAF = ____

*Sample size too small to be meaningful.

- ASTHMA -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 36

Profile:
Primary Diagnosis: 493.0
Single Diagnosis
Without Surgery
Active Duty
Age: 0-19
Sex: Male



PAS = ...
ARMY = -.-.
NAVY = ----
USAF = ____

- ASTHMA -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 37

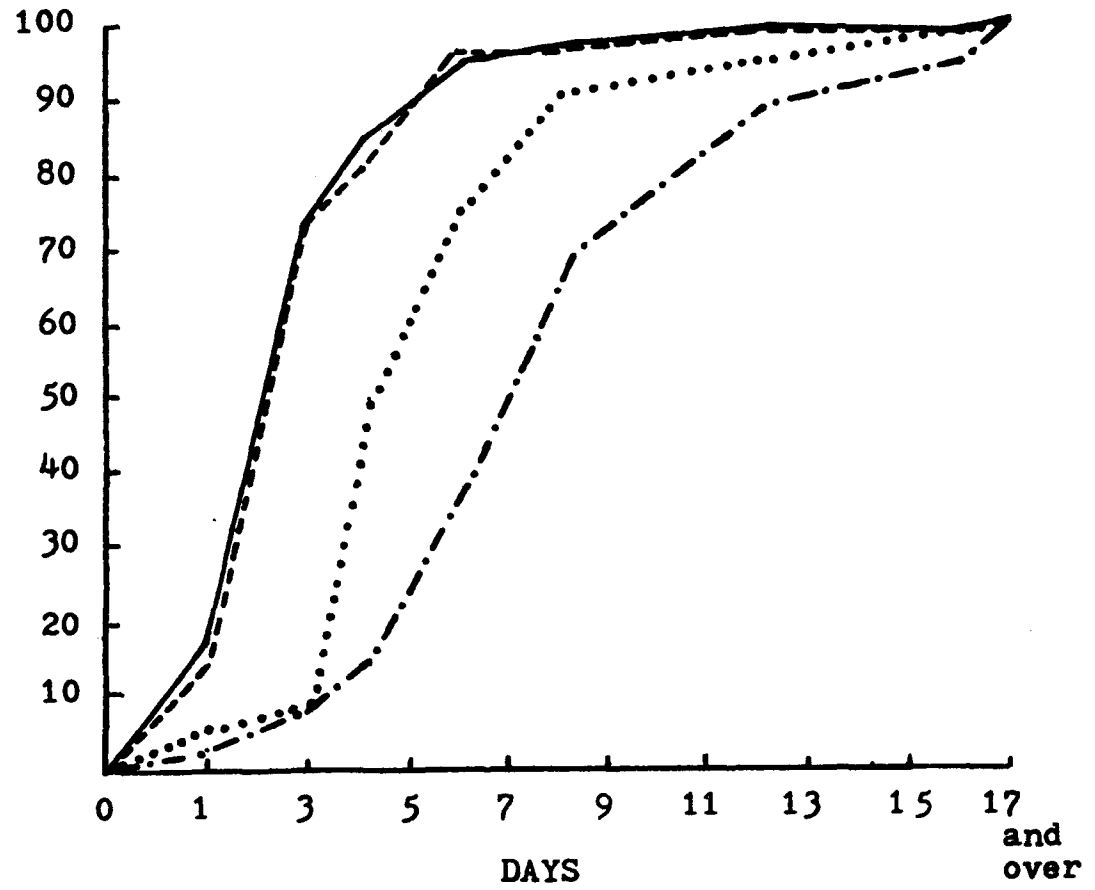
Profile:
Primary Diagnosis: 493.0
Single Diagnosis
Without Surgery
Non-Active Duty
Age: 0-19
Sex: Male

PAS = ...

ARMY = -.-.

NAVY = ----

USAF = ____



- HYPERTROPHY OF TONSILS AND ADENOIDS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY:
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 38

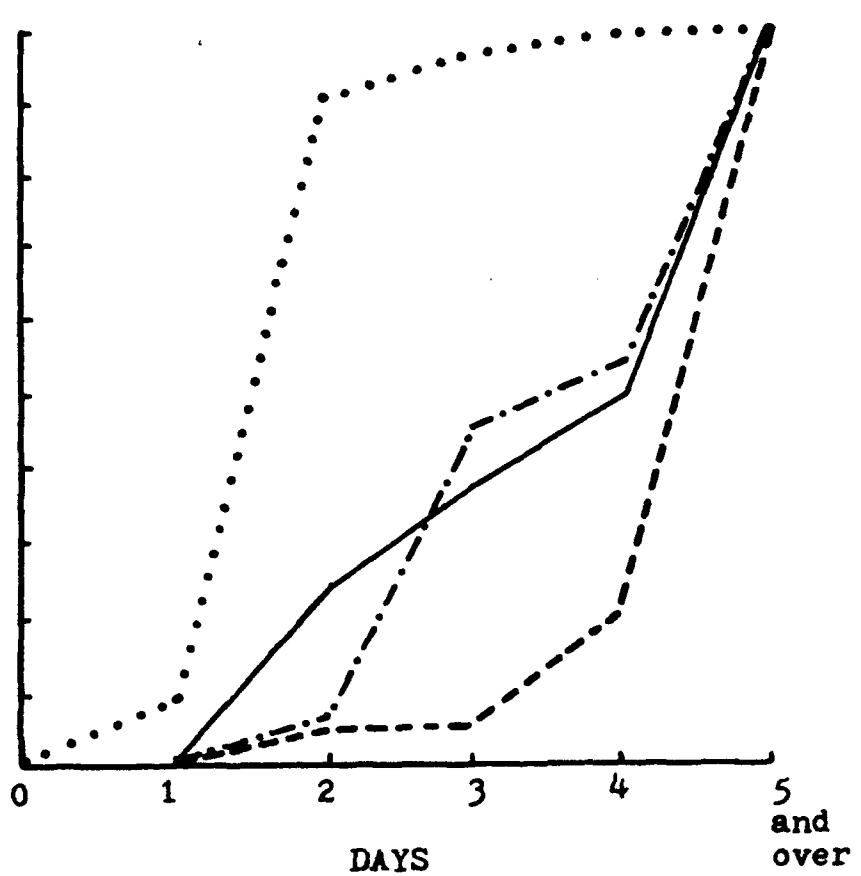
Profile:
Primary Diagnosis: 500.0
Single Diagnosis
With Surgery
Active Duty
Age: 0-19
Sex: Female

PAS = ...

ARMY = -.-.

NAVY = ----

USAF = ____



- HYPERTROPHY OF TONSILS AND ADENOIDS -
PERCENTAGE OF PATIENTS DISCHARGED BY DAY;
A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 39

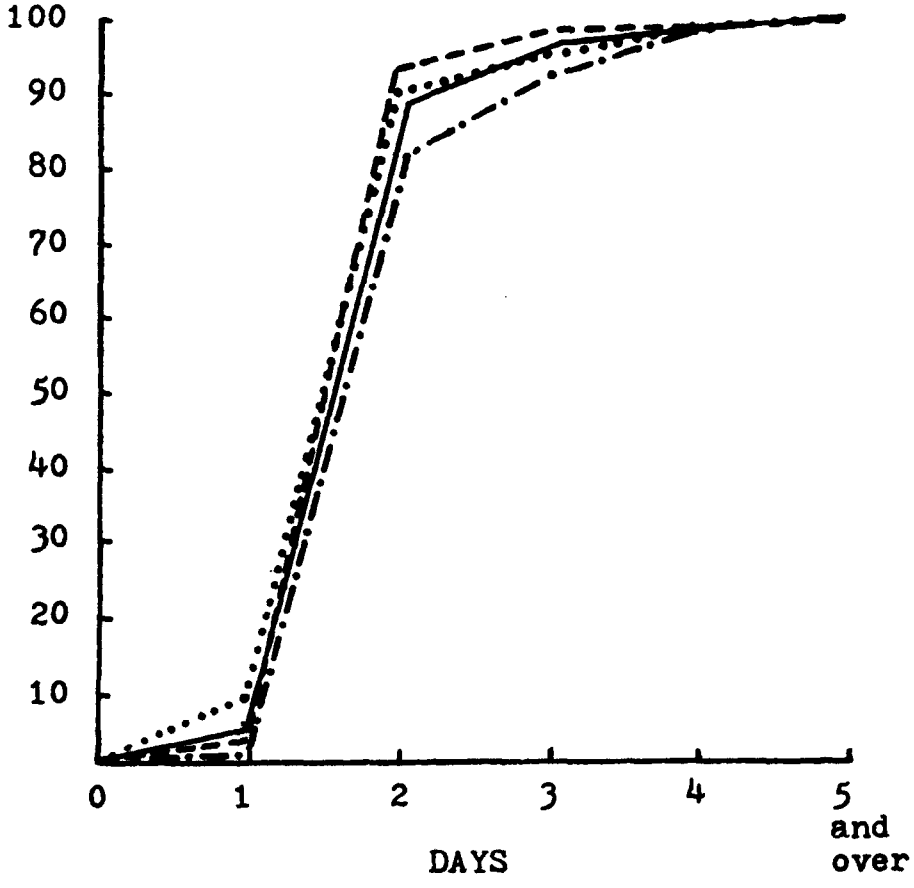
Profile:
Primary Diagnosis: 500.0
Single Diagnosis
With Surgery
Non-Active Duty
Age: 0-19
Sex: Female

PAS = ...

ARMY = -.-.

NAVY = ----

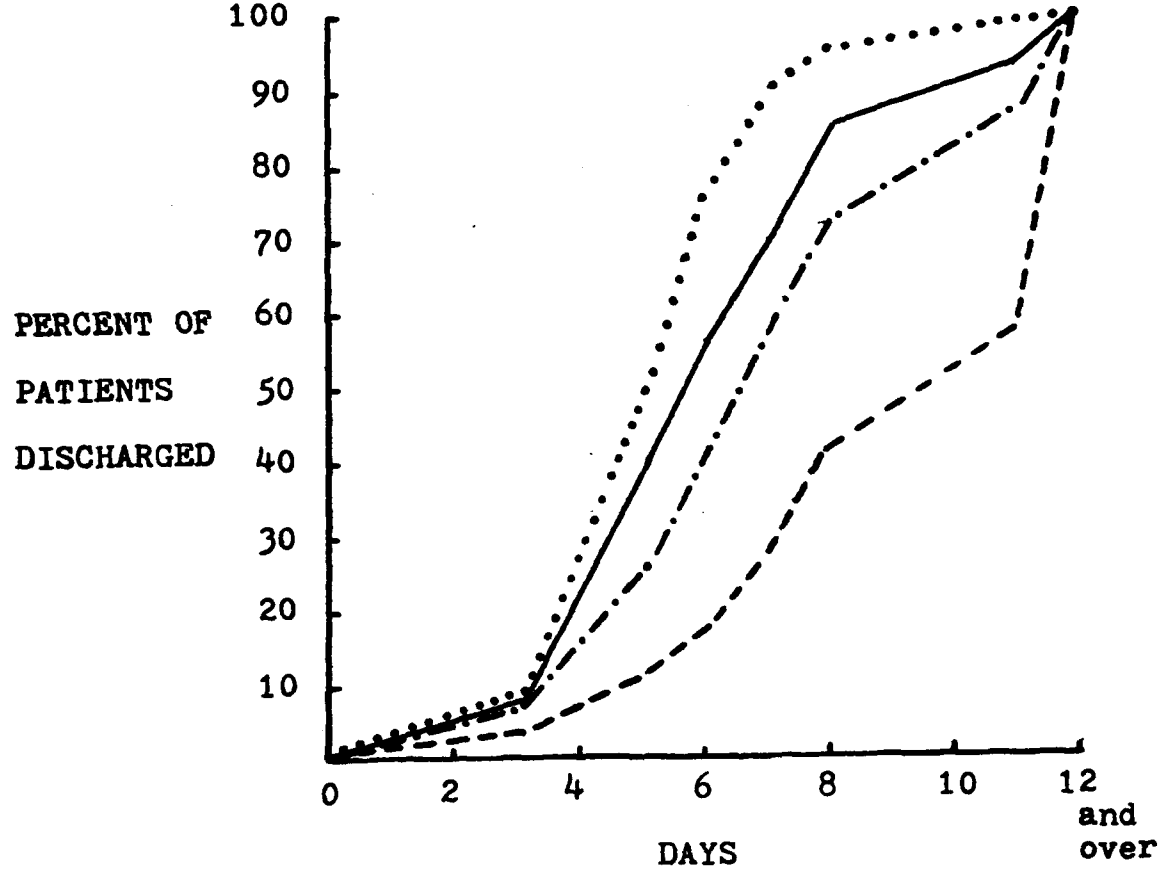
USAF = ____



- INGUINAL HERNIA, WITHOUT OBSTRUCTION - PERCENTAGE OF PATIENTS DISCHARGED BY DAY; A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 40

Profile:
Primary Diagnosis: 550.0
Single Diagnosis
With Surgery
Active Duty
Age: 20-34
Sex: Male



PAS = ...

ARMY = -.-.

NAVY = ----

USAF = ____

- INGUINAL HERNIA, WITHOUT OBSTRUCTION - PERCENTAGE OF PATIENTS DISCHARGED BY DAY; A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 41

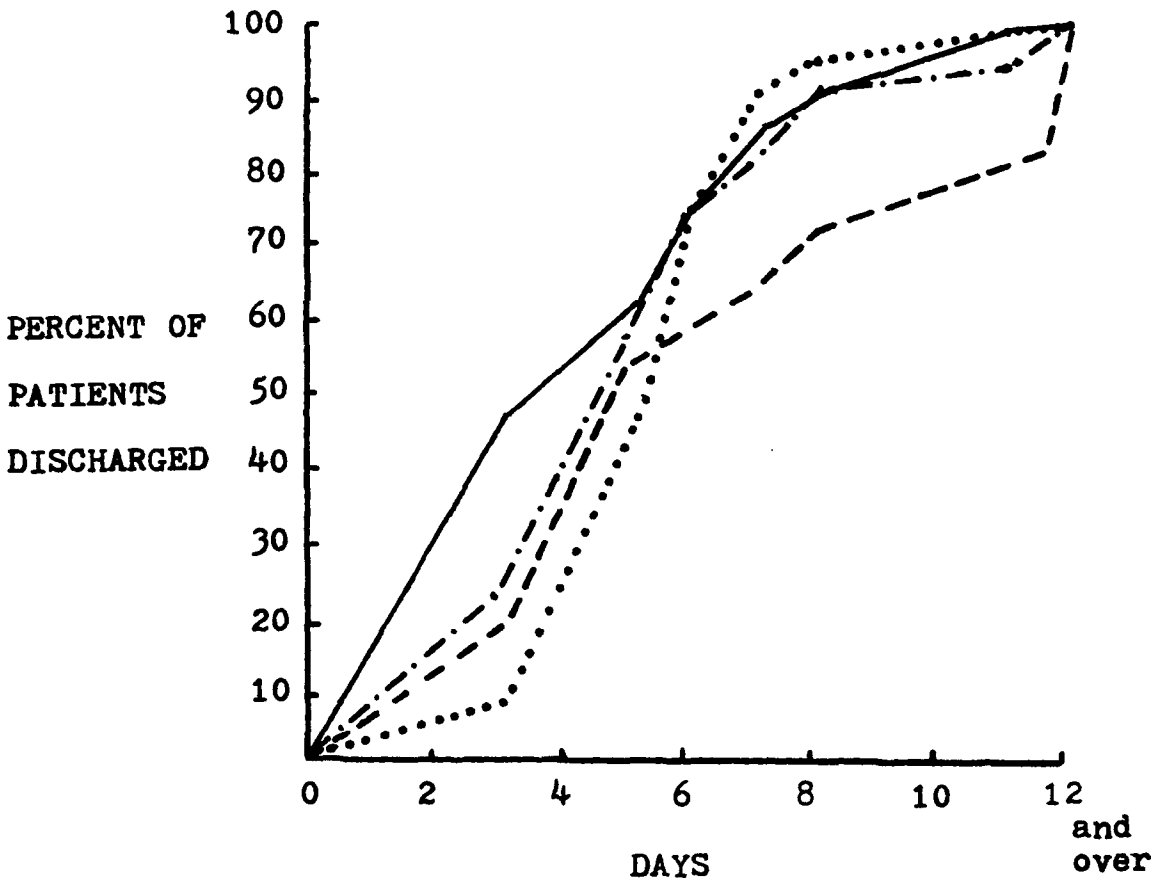
Profile:
Primary Diagnosis: 550.0
Single Diagnosis
With Surgery
Non-Active Duty
Age: 20-34
Sex: Male

PAS = ...

ARMY = -.-.

NAVY = ----

USAF = ____



- DELIVERY WITHOUT COMPLICATION - PERCENTAGE OF PATIENTS DISCHARGED BY DAY; A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 42

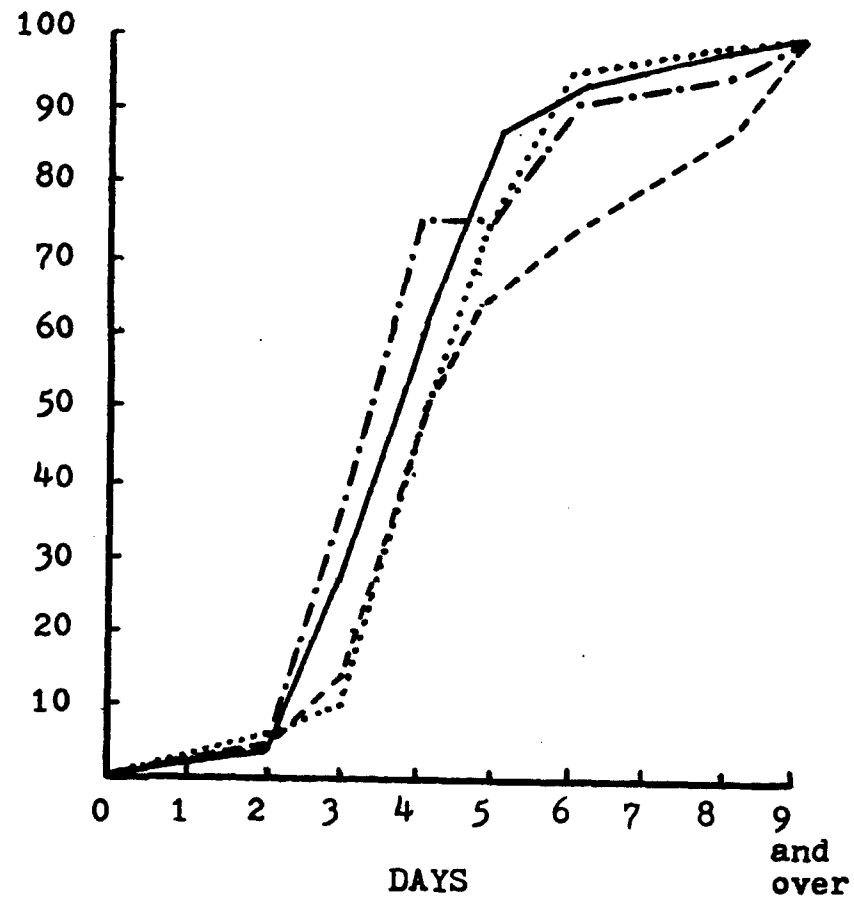
Profile:
Primary Diagnosis: 650.0
Single Diagnosis
With Surgery
Active Duty
Age: 20-34
Sex: Female

PAS = ...

ARMY = -.-.

NAVY = ----

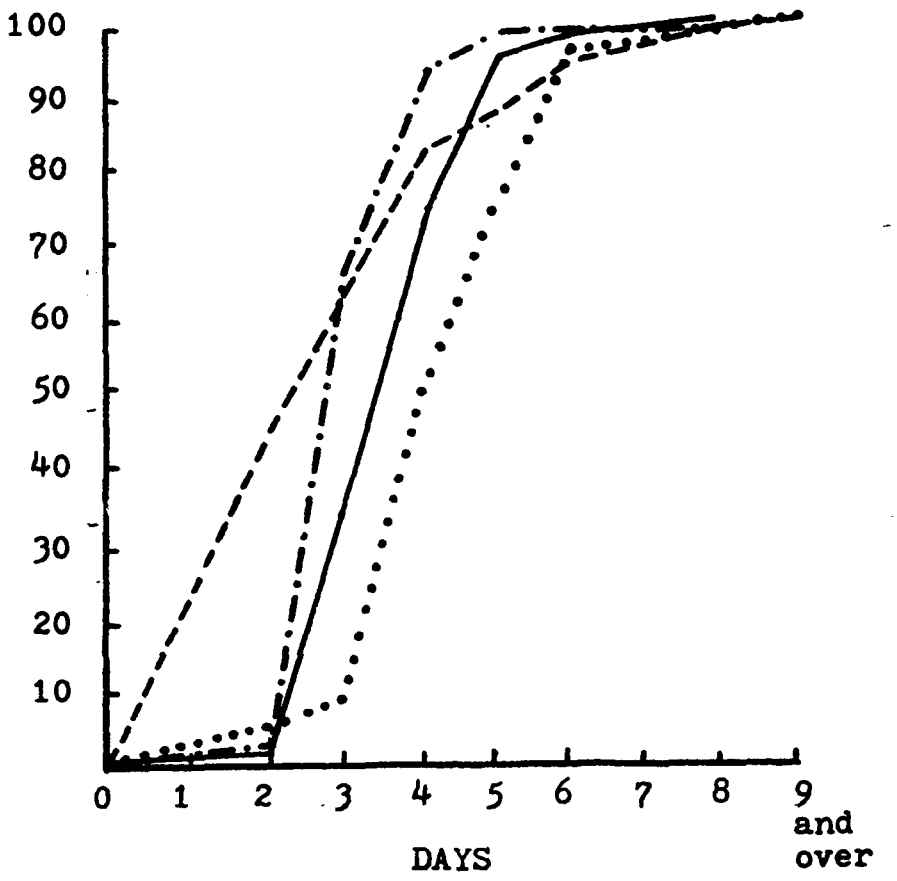
USAF = ____



- DELIVERY WITHOUT COMPLICATION - PERCENTAGE OF PATIENTS DISCHARGED BY DAY: A COMPARISON OF THE FOUR HEALTH CARE SYSTEMS

Table 43

Profile:
Primary Diagnosis: 650.0
Single Diagnosis
With Surgery
Non-Active Duty
Age: 20-34
Sex: Female



PAS = ...

ARMY = -.-.

NAVY = ----

USAF = ____

IV SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

For those readers who lack the time or inclination to read this entire paper, this chapter presents a summary of the major findings, the conclusions reached by this writer, and several recommendations based on those findings and conclusions.

A - Summary of Findings

HYPOTHESIS 1: Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 2: Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 3: Active duty military patients hospitalized in U.S. Naval hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 4: Non-active duty military patients hospitalized in U.S. Naval hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 5: Active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 6: Non-active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as patients who are comparable in terms of selected age, diagnostic, and surgical characteristics but are hospitalized in PAS hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 7: Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as active duty military patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 8: Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as non-active duty patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 9: Active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as active duty military patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Air Force hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 10: Non-active duty military patients hospitalized in U.S. Army hospitals experience the same lengths of stay as non-active duty military patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Air Force hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 11: Active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as active duty military patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.
REJECTED, accept the alternative.

HYPOTHESIS 12: Non-active duty military patients hospitalized in U.S. Air Force hospitals experience the same lengths of stay as non-active duty military patients who are comparable in terms of selected age, sex, diagnostic, and surgical characteristics but are hospitalized in U.S. Naval hospitals.
REJECTED, accept the alternative.

B - Conclusions

1. The lengths of stay of active duty military patients treated in Naval hospitals appear to be consistently longer than comparable patients treated in PAS, Army, or Air Force hospitals.
2. The lengths of stay of comparable active duty military patients treated in Army and Air Force hospitals, while determined to be different by hypothesis testing, show no conclusive evidence of one hospital system experiencing consistently shorter lengths of stay than the other.
3. The lengths of stay of comparable non-active duty military patients are different in each of the three military services' hospital systems. However, the patient samples studied indicated that no particular military medical service experienced consistently shorter lengths of stay than the other two military medical services.
4. Because of the difficulties experienced in matching PAS and DoD patients, one must be extremely cautious in reaching conclusions concerning the relative length of stay performance of PAS and DoD hospitals. The hypothesis testing indicated that lengths of stay in DoD hospitals are, indeed, different than those experienced by comparable patients hospitalized

in PAS hospitals. However, an examination of their respective average lengths of stay and the cumulative frequency distributions of the samples revealed -- with the exception of active duty military patients treated in Naval hospitals -- no clear pattern of one health care delivery system experiencing shorter lengths of stay than the other.

5. Even with the full cooperation of the three military medical services, obtaining comparable inpatient data from all three is an immensely tedious and time-consuming task. The information systems are enough alike to encourage comparative studies, but sufficiently dissimilar to frustrate even the most diligent manager or researcher.
6. Although not addressed formally or tested statistically in this study, the average lengths of stay for non-active duty military patients appear to be generally shorter than those of comparable active duty military patients. The reasons for this apparent disparity are beyond the scope of this study. However, this writer speculates that the longer lengths of stay of active duty military patients are attributed to the fact that many such patients' lack of a home environment to which they can return to convalesce and to administrative procedures rather than to differences in medical treatment received by active duty and non-active duty military patients.

C - Recommendations for Further Study

1. A study to determine the extent of hospitalization in military hospitals beyond the point that acute medical care is required.
2. A study of the impact which expanded domiciliary care facilities would have on acute hospital patient days, costs of care, and medical personnel requirements.
3. A study to determine military physicians' attitudes toward quality assurance and utilization review programs in the military medical systems.
4. A study to compare the views of Medical Corps officers and Medical Service Corps officers on the conduct and purpose of quality assurance and utilization review in the military hospital environment.
5. An expanded version of this study which would include a wider variety of patient profiles and possibly identify areas of concern for utilization review within the Department of Defense health care delivery system.
6. A study of the patient information systems of the three military medical systems and the possibility of creating a unified system.

7. A study to determine the elements, if any, within the present military budgetary systems which encourage overutilization of health resources.

A P P E N D I C E S

TABLE OF APPENDICES

APPENDIX A
U.S. MILITARY HOSPITALS
CONTINENTAL UNITED STATES (CONUS)
(INCLUDES ALASKA AND HAWAII)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	ALABAMA		
Fort McClellan	Noble Army Hospital	Anniston	60
Fort Rucker	Lyster Army Hospital	Daleville	80
Redstone Arsenal	U.S. Army Hospital	Huntsville	35
Maxwell Air Force Base	USAF Regional Hospital	Montgomery	200
	ALASKA		
Fort Jonathan M. Wainwright	Bassett Army Hospital	Fairbanks	70
Eielson Air Force Base	U.S. Air Force Hospital	Fairbanks	20
Elmendorf Air Force Base	U.S. Air Force Hospital	Anchorage	200
	ARIZONA		
Fort Huachuca	Raymond W. Bliss Army Hosp.	Fort Huachuca	70
Yuma Proving Ground	U.S. Army Hospital	Yuma	5
Davis-Monthan Air Force Base	U.S. Air Force Hospital	Tucson	80
Luke Air Force Base	U.S. Air Force Hospital	Phoenix	60
Williams Air Force Base	U.S. Air Force Hospital	Chandler	25
	ARKANSAS		
Blytheville Air Force Base	U.S. Air Force Hospital	Blytheville	20
Little Rock Air Force Base	U.S. Air Force Hospital	Little Rock	40

APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	CALIFORNIA		
Fort Ord	Silas B. Hays Army Hospital	Monterey	450
Letterman Army Med Center	Letterman General Hospital	San Francisco	510
Sierra Army Depot	U.S. Army Hospital	Herlong	5
Camp Pendleton	Naval Hospital	Oceanside	335
Naval Air Station	Naval Hospital	Lemoore	50
Long Beach	Naval Hospital	Long Beach	250
Oakland	Naval Hospital	Oakland	615
Naval Constrctn. Btln. Center	Naval Hospital	Port Hueneme	55
San Diego	Naval Hospital	San Diego	1415
Beale Air Force Base	U.S. Air Force Hospital	Marysville	30
Castle Air Force Base	U.S. Air Force Hospital	Merced	30
Edwards Air Force Base	U.S. Air Force Hospital	Muroc	30
George Air Force Base	U.S. Air Force Hospital	Victorville	40
March Air Force Base	USAF Regional Hospital	Riverside	165
Mather Air Force Base	USAF Hospital	Sacramento	85
Travis Air Force Base	David Grant USAF Med Center	Fairfield	385
Vandenberg Air Force Base	USAF Hospital	Lompoc	70
	COLORADO		
Fitzsimons Army Med Center	Fitzsimons General Hospital	Denver	710
Fort Carson	U.S. Army Hospital	Colorado Springs	210
Air Force Academy	USAF Academy Hospital	Colorado Springs	110
	CONNECTICUT		
Naval Submarine Med Center, New London	Naval Hospital	New London	80

APPENDIX A(continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	DELAWARE		
Dover Air Force Base	U.S. Air Force Hospital	Dover	55
	FLORIDA		
Naval Station, Jacksonville	Naval Hospital	Jacksonville	240
NAS, Key West	Naval Hospital	Key West	55
NTC, Orlando	Naval Hospital	Orlando	93
Naval Aerospace Med Center	Naval Hospital	Pensacola	190
Eglin Air Force Base	USAF Regional Hospital	Valparaiso	180
Homestead Air Force Base	U.S. Air Force Hospital	Homestead	90
MacDill Air Force Base	USAF Regional Hospital	Tampa	150
Patrick Air Force Base	U.S. Air Force Hospital	Cocoa	35
Tyndall Air Force Base	U.S. Air Force Hospital	Panama City	60
	GEORGIA		
Fort Benning	Martin Army Hospital	Columbus	370
Fort Gordon	U.S. Army Hospital	Grovetown	325
Fort McPherson	U.S. Army Hospital	Atlanta	60
Fort Stewart	U.S. Army Hospital	Hinesville	30
Moody Air Force Base	U.S. Air Force Hospital	Valdosta	25
Robins Air Force Base	U.S. Air Force Hospital	Warner Robins	60
	HAWAII		
Tripler Army Med Center	Tripler General Hospital	Moanalua	600
	IDAHO		
Mountain Home AFB	U.S. Air Force Hospital	Mountain Home	40

APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	ILLINOIS		
Great Lakes Naval Training Center	Naval Hospital	Great Lakes	400
Chanute Air Force Base	U.S. Air Force Hospital	Rantoul	65
Scott Air Force Base	USAF Med Center	Belleville	300
	INDIANA		
Fort Benjamin Harrison	U.S. Army Hospital	Indianapolis	40
Grissom Air Force Base	U.S. Air Force Hospital	Peru	20
	KANSAS		
Fort Leavenworth	Munson Army Hospital	Leavenworth	60
Fort Riley	Irwin Army Hospital	Junction City	290
McConnell Air Force Base	U.S. Air Force Hospital	Wichita	30
	KENTUCKY		
Fort Campbell	U.S. Army Hospital	Clarksville, TN	290
Fort Knox	Ireland Army Hospital	West Point	660
	LOUISIANA		
Fort Polk	U.S. Army Hospital	Leesville	370
Barksdale Air Force Base	U.S. Air Force Hospital	Shreveport	70
England Air Force Base	U.S. Air Force Hospital	Alexandria	40
	MAINE		
Loring Air Force Base	U.S. Air Force Hospital	Limestone	25

APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	MARYLAND		
Aberdeen Proving Ground	Kirk Army Hospital	Aberdeen	60
Fort George G. Meade	Kimbrough Army Hospital	Odenton	125
Annapolis	Naval Hospital	Annapolis	55
National Naval Med Center	Naval Hospital	Bethesda	590
Patuxent Naval Air Station	Naval Hospital	Patuxent	30
Andrews Air Force Base	Malcolm Grow USAF Med Center	Camp Springs	350
	MASSACHUSETTS		
Fort Devens	U.S. Army Hospital	Ayer	100
Boston Naval Complex	Naval Hospital	Chelsea	300
Westover Air Force Base	U.S. Air Force Hospital	Chicopee Falls	20
	MICHIGAN		
K.I. Sawyer Air Force Base	U.S. Air Force Hospital	Gwinn	30
Kincheloe Air Force Base	U.S. Air Force Hospital	Kinross	25
Wurtsmith Air Force Base	U.S. Air Force Hospital	Oscoda	25
	MISSISSIPPI		
Columbus Air Force Base	U.S. Air Force Hospital	Columbus	25
Keesler Air Force Base	USAF Med Center	Biloxi	350
	MISSOURI		
Fort Leonard Wood	General Leonard Wood Army Hospital	Waynesville	540
Richards Gebaur AFB	U.S. Air Force Hospital	Grandview	33
Whiteman Air Force Base	U.S. Air Force Hospital	Sedalia	25

APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	MONTANA		
Malmstrom Air Force Base	U.S. Air Force Hospital	Great Falls	30
	NEBRASKA		
Offutt Air Force Base	Ehrling Bergquist USAF Regional Hospital	Omaha	90
	NEVADA		
Nellis Air Force Base	U.S. Air Force Hospital	Las Vegas	50
	NEW HAMPSHIRE		
Portsmouth Naval Complex	Naval Hospital	Portsmouth	55
	NEW JERSEY		
Fort Dix	Walson Army Hospital	Wrightstown	630
Fort Monmouth	Patterson Army Hospital	Oceanport	80
	NEW MEXICO		
White Sands Missile Range	McAfee Army Hospital	Las Cruces	50
Cannon Air Force Base	U.S. Air Force Hospital	Clovis	40
Holloman Air Force Base	U.S. Air Force Hospital	Alamogordo	40
Kirtland Air Force Base	U.S. Air Force Hospital	Albuquerque	80
	NEW YORK		
U.S. Military Academy	U.S. Army Hospital	West Point	100
Griffiss Air Force Base	U.S. Air Force Hospital	Rome	20
Plattsburgh Air Force Base	U.S. Air Force Hospital	Plattsburgh	30

APPENDIX A(continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	NORTH CAROLINA		
Fort Bragg	Womack Army Hospital	Fayetteville	450
Camp Lejeune	Naval Hospital	Camp Lejeune	380
Marine Corps Air Station	Naval Hospital	Cherry Point	60
Seymour Johnson AFB	U.S. Air Force Hospital	Goldsboro	40
	NORTH DAKOTA		
Grand Forks Air Force Base	U.S. Air Force Hospital	Grand Forks	35
Minot Air Force Base	USAF Regional Hospital	Minot	80
	OHIO		
Lockbourne Air Force Base	U.S. Air Force Hospital	Columbus	30
Wright-Patterson AFB	USAF Medical Center	Dayton	375
	OKLAHOMA		
Fort Sill	Reynolds Army Hospital	Lawton	225
Altus Air Force Base	U.S. Air Force Hospital	Altus	35
Tinker Air Force Base	U.S. Air Force Hospital	Oklahoma City	60
	PENNSYLVANIA		
Carlisle Barracks	Dunham Army Hospital	Carlisle	20
Naval Regional Med Center, Philadelphia	Naval Hospital	Philadelphia	800
	RHODE ISLAND		
Newport	Naval Hospital	Newport	200

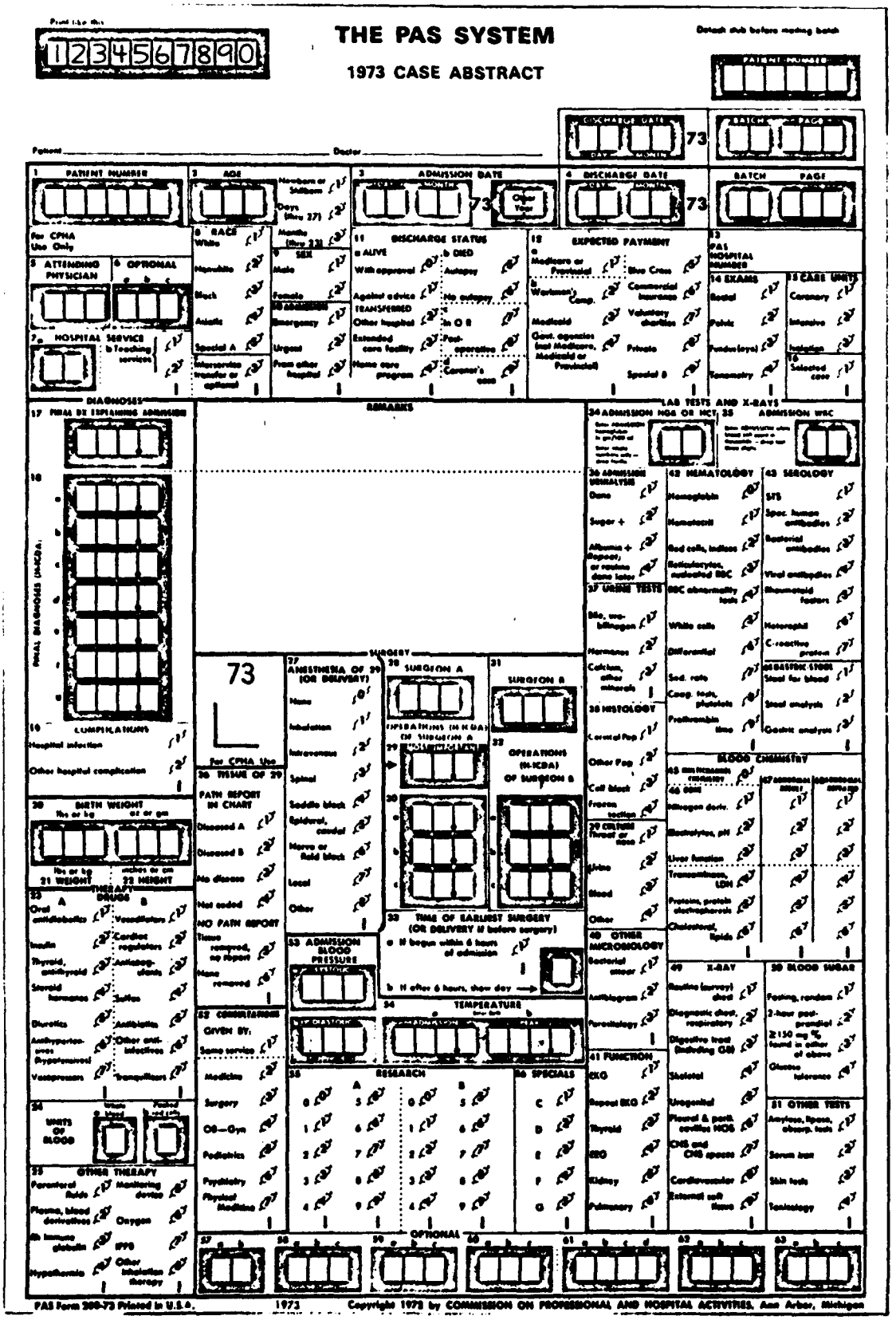
APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	SOUTH CAROLINA		
Fort Jackson	U.S. Army Hospital	Columbia	590
Beaufort	Naval Hospital	Beaufort	160
Charleston	Naval Hospital	Charleston	360
Myrtle Beach AFB	U.S. Air Force Hospital	Myrtle Beach	30
Shaw Air Force Base	USAF Regional Hospital	Sumter	80
	SOUTH DAKOTA		
Ellsworth Air Force Base	U.S. Air Force Hospital	Rapid City	40
	TENNESSEE		
Naval Air Station, Memphis	Naval Hospital	Memphis	170
	TEXAS		
U.S. Army	Wm. Beaumont General Hosp.	El Paso	460
Fort Hood	Darnall Army Hospital	Killeen	250
Fort Sam Houston	Brooke General Hospital, Brooke Army Med Center	San Antonio	750
Corpus Christi	Naval Hospital	Corpus Christi	200
Bergstrom Air Force Base	U.S. Air Force Hospital	Austin	40
Carswell Air Force Base	USAF Regional Hospital	Fort Worth	165
Dyess Air Force Base	U.S. Air Force Hospital	Abilene	40
Goodfellow Air Force Base	U.S. Air Force Hospital	San Angelo	20
Lackland Air Force Base	Wilford Hall USAF Med Center	San Antonio	1000
Laughlin Air Force Base	U.S. Air Force Hospital	Del Rio	25
Reese Air Force Base	U.S. Air Force Hospital	Lubbock	25
Sheppard Air Force Base	USAF Regional Hospital	Wichita Falls	250
Webb Air Force Base	U.S. Air Force Hospital	Big Spring	25

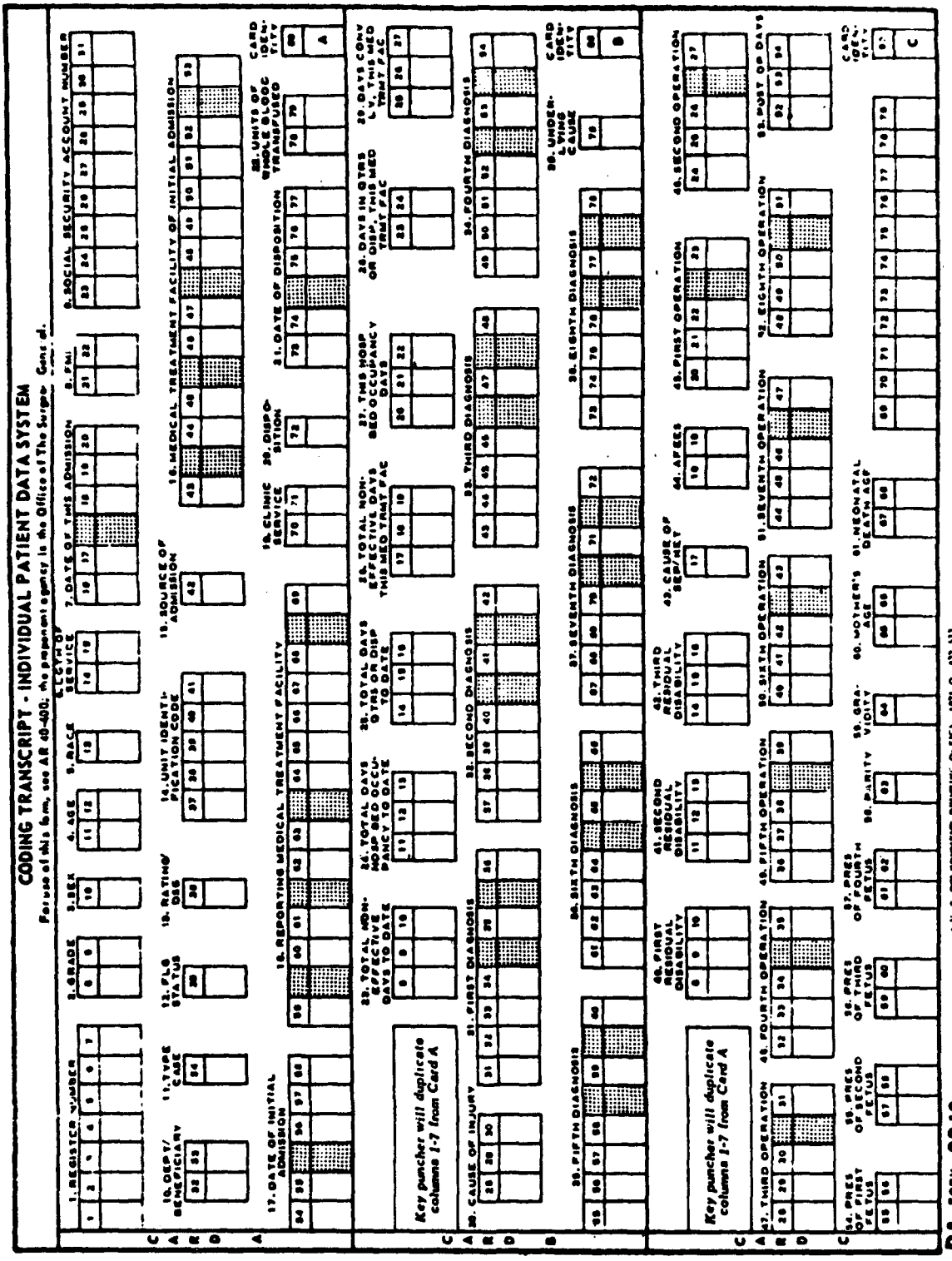
APPENDIX A (continued)

INSTALLATION	HOSPITAL	LOCATION	OPERATING BEDS
	UTAH		
Dugway Proving Ground	U.S. Army Hospital	Dugway	10
Hill Air Force Base	U.S. Air Force Hospital	Ogden	30
	VIRGINIA		
Fort Belvoir	DeWitt Army Hospital	Accotink	190
Fort Eustis	McDonald Army Hospital	Lee Hall	90
Fort Lee	Kenner Army Hospital	Petersburg	120
Naval Regional Med Center	Naval Hospital	Portsmouth	950
Marine Corps Base	Naval Hospital	Quantico	75
Langley Air Force Base	U.S. Air Force Hospital	Hampton	110
	WASHINGTON		
Fort Lewis	Madigan General Hospital, Madigan Army Med Center	Tacoma	460
Bremerton	Naval Hospital	Bremerton	110
Whidbey Island	Naval Hospital	Whidbey Island	25
Fairchild Air Force Base	USAF Regional Hospital	Spokane	70
	WASHINGTON, D.C.		
Walter Reed Army Med Center	Walter Reed General Hospital	Washington, D.C.	870
	WYOMING		
Francis E. Warren Air Force Base	U.S. Air Force Hospital	Cheyenne	20

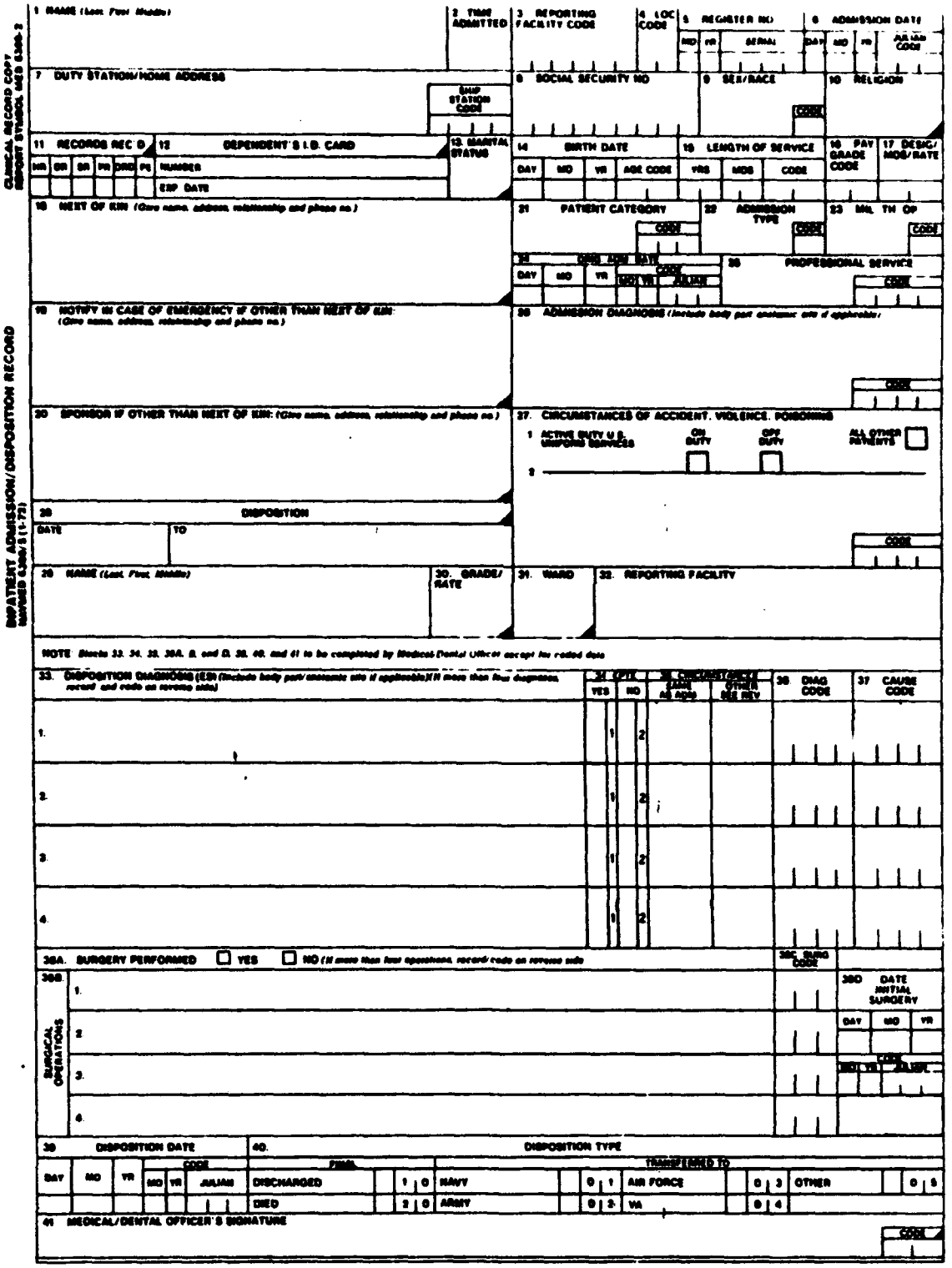
APPENDIX B
PAS CASE ABSTRACT



APPENDIX C
ARMY CASE ABSTRACT



APPENDIX D
NAVY CASE ABSTRACT



CLINICAL RECORD COPY
REPORT SYMBOL MED 6300-2

INPATIENT ADMISSION/DISPOSITION RECORD
REVISED 6300/5 (1-72)

1 NAME (Last, First, Middle) | 2 TIME ADMITTED | 3 REPORTING FACILITY CODE | 4 LOC CODE | 5 REGISTER NO. (MO, YR, SERIAL) | 6 ADMISSION DATE (DAY, MO, YR, AUTH CODE)

7 DUTY STATION/HOME ADDRESS | SHIP STATION CODE | 8 SOCIAL SECURITY NO | 9 SEX/RACE CODE | 10 RELIGION

11 RECORDS REC'D (HR, DR, SR, PR, DRE, PE) | 12 DEPENDENT'S I.D. CARD NUMBER, EXP DATE | 13 MARITAL STATUS | 14 BIRTH DATE (DAY, MO, YR, AGE CODE) | 15 LENGTH OF SERVICE (YRS, MOS, CODE) | 16 PAY GRADE CODE | 17 DESIG/ MOS/RATE

18 NEXT OF KIN (Give name, address, relationship and phone no.)

21 PATIENT CATEGORY CODE | 22 ADMISSION TYPE CODE | 23 MIL TH OP CODE

24 DIAG. ADM. DATE (DAY, MO, YR, CODE, JULIAN) | 25 PROFESSIONAL SERVICE CODE

19 NOTIFY IN CASE OF EMERGENCY IF OTHER THAN NEXT OF KIN: (Give name, address, relationship and phone no.)

26 ADMISSION DIAGNOSIS (Include body part, anatomic site if applicable) CODE

20 SPONSOR IF OTHER THAN NEXT OF KIN: (Give name, address, relationship and phone no.)

27. CIRCUMSTANCES OF ACCIDENT, VIOLENCE, POISONING
1 ACTIVE ENTY U.S. UNIFORM SERVICES: ON DUTY | OFF DUTY | ALL OTHER PATIENTS
2 CODE

28 DISPOSITION
DATE | TO

29 NAME (Last, First, Middle) | 30. GRADE/ RATE | 31. WARD | 32. REPORTING FACILITY

NOTE Blocks 33, 34, 35, 36A, B, and D, 38, 40, and 41 to be completed by Medical/Dental Officer except for coded data

33. DISPOSITION DIAGNOSIS (ICD) (Include body part/anatomic site if applicable) If more than four diagnoses, record and code on reverse side

	34. OPR YES	34. OPR NO	35. CIRCUMSTANCES (EXT. CAUSE All Apply)	35. CIRCUMSTANCES (EXT. CAUSE Other See Rev)	36 DIAG CODE	37 CAUSE CODE
1.		1 2				
2.		1 2				
3.		1 2				
4.		1 2				

36A. SURGERY PERFORMED ☐ YES ☐ NO (If more than four operations, record/code on reverse side) | 36C. SURG CODE

SURGICAL OPERATIONS

	36C. SURG CODE	36D DATE INITIAL SURGERY (DAY, MO, YR, CODE, JULIAN)
36B. 1.		
2.		
3.		
4.		

39 DISPOSITION DATE (DAY, MO, YR, CODE, MO, YR, JULIAN)

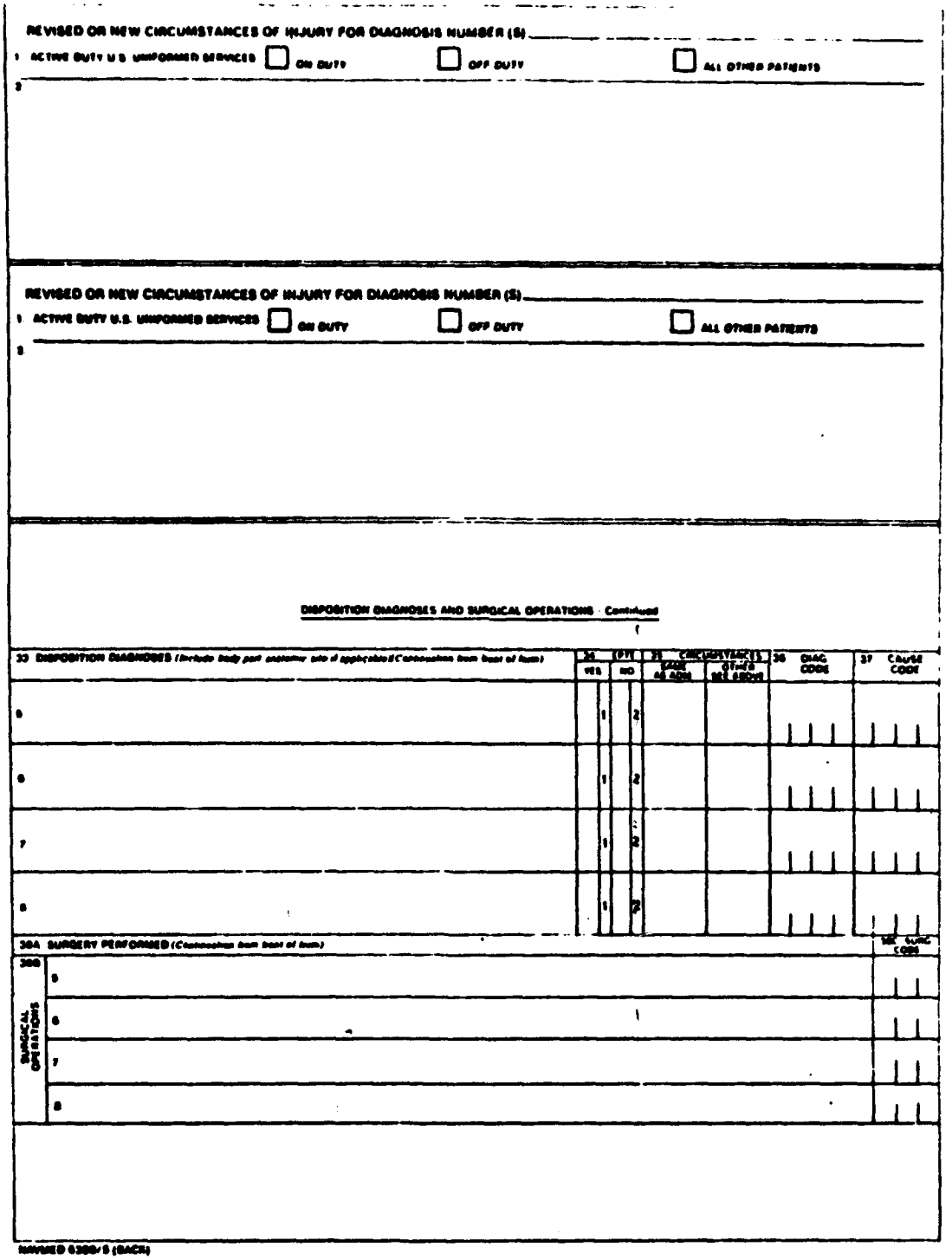
40. DISPOSITION TYPE

FINAL		TRANSFERRED TO			
DISCHARGED	1 0	NAVY	0 1	AIR FORCE	0 3
DIED	2 0	ARMY	0 2	VA	0 4

OTHER 0 5

41 MEDICAL/DENTAL OFFICER'S SIGNATURE | CODE

APPENDIX D (continued)



REVISED OR NEW CIRCUMSTANCES OF INJURY FOR DIAGNOSIS NUMBER (S) _____

1 ACTIVE DUTY U S UNIFORMED SERVICES ☐ ON DUTY ☐ OFF DUTY ☐ ALL OTHER PATIENTS

2

REVISED OR NEW CIRCUMSTANCES OF INJURY FOR DIAGNOSIS NUMBER (S) _____

1 ACTIVE DUTY U.S. UNIFORMED SERVICES ☐ ON DUTY ☐ OFF DUTY ☐ ALL OTHER PATIENTS

2

DISPOSITION DIAGNOSES AND SURGICAL OPERATIONS - Continued

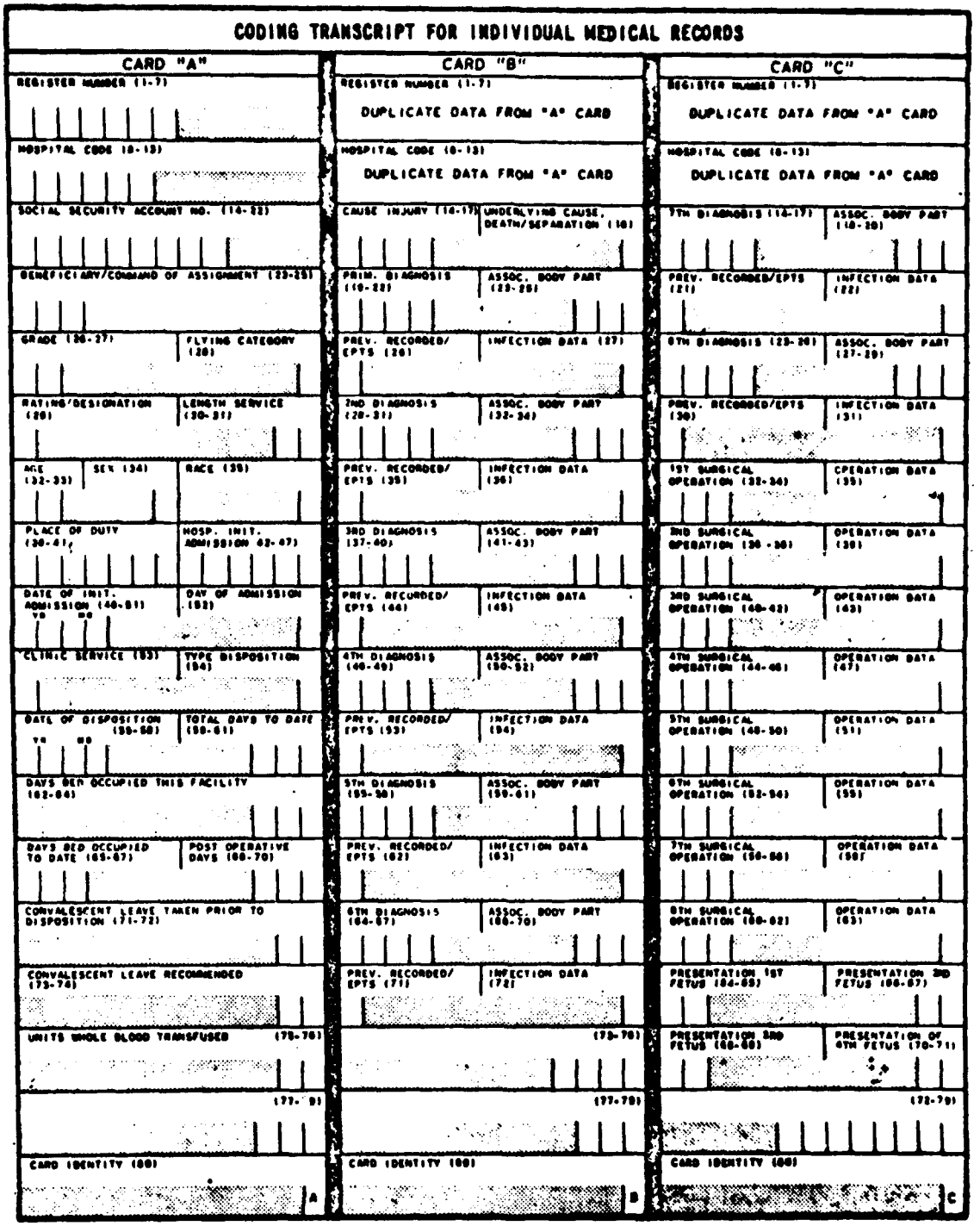
33 DISPOSITION DIAGNOSES (Include body part anatomy site if applicable) (Continuation from front of form)	34 (PY) YES	34 (PY) NO	35 CONDITION(S) ARISE AS ADM	35 CONDITION(S) ARISE OTHWISE	36 DIAG CODE	37 CAUSE CODE
5	1	2				
6	1	2				
7	1	2				
8	1	2				

38A SURGERY PERFORMED (Continuation from front of form) — SEE CLINIC CODE

38B SURGICAL OPERATIONS		
	5	
	6	
	7	
	8	

NAVMED 6300/5 (BACK)

APPENDIX E
AIR FORCE CASE ABSTRACT



CODING TRANSCRIPT FOR INDIVIDUAL MEDICAL RECORDS

CARD "A"

REGISTER NUMBER (1-7)

HOSPITAL CODE (8-12)

SOCIAL SECURITY ACCOUNT NO. (14-22)

BENEFICIARY/COMMAND OF ASSIGNMENT (23-25)

GRADE (26-27) | FLYING CATEGORY (28)

RATING/DESIGNATION (29) | LENGTH SERVICE (30-31)

AGE (32-33) | SEX (34) | RACE (35)

PLACE OF DUTY (36-41) | HOSP. INIT. ADMISSION 42-47)

DATE OF INIT. ADMISSION (48-51) YR MO | DAY OF ADMISSION (52)

CLINIC SERVICE (53) | TYPE DISPOSITION (54)

DATE OF DISPOSITION (55-58) YR MO | TOTAL DAYS TO DATE (59-61)

DAYS BED OCCUPIED THIS FACILITY (62-64)

DAYS BED OCCUPIED TO DATE (65-67) | POST OPERATIVE DAYS (68-70)

CONVALESCENT LEAVE TAKEN PRIOR TO DISPOSITION (71-72)

CONVALESCENT LEAVE RECOMMENDED (73-76)

UNITS WHOLE BLOOD TRANSFUSED (75-76)

(77-79)

CARD IDENTITY (80) | A

CARD "B"

REGISTER NUMBER (1-7)

DUPLICATE DATA FROM "A" CARD

HOSPITAL CODE (8-12)

DUPLICATE DATA FROM "A" CARD

CAUSE INJURY (14-17) | UNDERLYING CAUSE, DEATH/SEPARATION (18)

PRIM. DIAGNOSIS (19-22) | ASSOC. BODY PART (23-25)

PREV. RECORDED/EPTS (26) | INFECTION DATA (27)

2ND DIAGNOSIS (28-31) | ASSOC. BODY PART (32-34)

PREV. RECORDED/EPTS (35) | INFECTION DATA (36)

3RD DIAGNOSIS (37-40) | ASSOC. BODY PART (41-43)

PREV. RECORDED/EPTS (44) | INFECTION DATA (45)

4TH DIAGNOSIS (46-49) | ASSOC. BODY PART (50-52)

PREV. RECORDED/EPTS (53) | INFECTION DATA (54)

5TH DIAGNOSIS (55-58) | ASSOC. BODY PART (59-61)

PREV. RECORDED/EPTS (62) | INFECTION DATA (63)

6TH DIAGNOSIS (64-67) | ASSOC. BODY PART (68-70)

PREV. RECORDED/EPTS (71) | INFECTION DATA (72)

(75-76)

(77-79)

CARD IDENTITY (80) | B

CARD "C"

REGISTER NUMBER (1-7)

DUPLICATE DATA FROM "A" CARD

HOSPITAL CODE (8-12)

DUPLICATE DATA FROM "A" CARD

7TH DIAGNOSIS (14-17) | ASSOC. BODY PART (18-20)

PREV. RECORDED/EPTS (21) | INFECTION DATA (22)

8TH DIAGNOSIS (23-26) | ASSOC. BODY PART (27-29)

PREV. RECORDED/EPTS (30) | INFECTION DATA (31)

1ST SURGICAL OPERATION (32-34) | OPERATION DATA (35)

2ND SURGICAL OPERATION (36-38) | OPERATION DATA (39)

3RD SURGICAL OPERATION (40-42) | OPERATION DATA (43)

4TH SURGICAL OPERATION (44-46) | OPERATION DATA (47)

5TH SURGICAL OPERATION (48-50) | OPERATION DATA (51)

6TH SURGICAL OPERATION (52-54) | OPERATION DATA (55)

7TH SURGICAL OPERATION (56-58) | OPERATION DATA (59)

8TH SURGICAL OPERATION (60-62) | OPERATION DATA (63)

PRESENTATION 1ST FETUS (64-65) | PRESENTATION 2ND FETUS (66-67)

PRESENTATION 3RD FETUS (68-69) | PRESENTATION OF 4TH FETUS (70-71)

(72-79)

CARD IDENTITY (80) | C

AF FORM 590 SEP 69 PREVIOUS EDITION WILL BE USED.

APPENDIX F

LETTER REQUESTING USAF DATA SERVICES SUPPORT

24 January 1974

Reply to Attn of: Capt Maxwell/56281

SUBJECT: Preparation of Biometric Data Tapes

TO: GLPS/TSGT Grant

1. As we discussed in our 24 January 1974 meeting, I request the preparation of a 7 track magnetic computer tape with the specifications listed in Attachments 1 and 2 of this letter.

2. If possible, I would like to receive the subject tapes on or about 1 February 1974.

3. I sincerely appreciate your assistance in this study.

William K. Maxwell
William K. Maxwell
Capt, USAF, MSC

APPENDIX F (continued)

Specifications for the Preparation of the Length of Stay Study Data Tape

Attachment 1.

1. Use the U.S. Air Force Conversion tape to convert U.S. Army and U.S. Navy Biometric data tapes to U.S. Air Force format. Please maintain each service's data on separate tapes.

2. Prepare a working tape of Calendar Year 1972 U.S. Air Force biometric data by using the following exclusion/selection criteria.

a. Exclude:

a. records with J, K, L, M, S, 7, 8, or 9 in Record Position 54 (Dispositions)

b. records with Y, Z, or 7 in Record Position 53

c. records where RP 8-13 does not equal RP 42-47

d. records with an alpha code in Record Position 10-11

b. Select records from each of 3 services according to the following table:

Record Position	Primary Diagnosis 82-85	Secondary Diagnosis 92-94	Age 32-33	Sex 34	Surgical Procedures 154-156
	0092	Blank	20-34	M	Blank
	2509	Blank	35-49	M	Blank
	4129	Blank	35-49	M	Entry
	4550	Blank	20-34	M	Entry
	4650	Blank	20-34	M	Blank
	4860	Blank	20-34	M	Blank
	4930	Blank	00-19*	M	Blank
	5000	Blank	00-19*	F	Entry
	5500	Blank	20-34	M	Entry
	6500	Blank	20-34	F	Entry

*ØD etc

APPENDIX F (continued)

3. For each source (service) separately divide the data groups developed in steps 2(a) and 2(b) according to Record Position 23-25 as follows.

a. Alpha, 013, 014, 017 - 019

b. All other entries

4. The completion of the exclusion and selection actions delineated above should result in the sorting of the biometric data files into 20 groups for each military service. Each data group should be standardized and ready for processing by pre-programmed statistical routines.

APPENDIX F (continued)

Data Elements to be Included
in the Data Files

Attachment 2.

AF Field	File Description	Record Position
7)	Current Grade	26-27
10)	Length of Service	30-31
11)	Age of Patient	32-33
12)	Sex of Patient	34
13)	Race of Patient	35
16)	Pre-Med Fac. Code	42-43
17)	Med Fac. of Initial Admission	44-47
20)	Day of the Week	52
22)	Disposition	54
26)	Bed days occupied this facility	62-64
34)	Primary Diagnosis	82-85
38)	Diagnosis-2	91-94
66)	Surgical Operation-1	154-156

APPENDIX G

COMPUTATION OF THE TEST STATISTIC (IBM Computer Subroutine KOLM2)

Given a sample of n i.i.d. (independent and identically distributed) random variables X, and a sample of m i.i.d. random variables Y, this subroutine tests the difference between the two empirical distribution functions $F_n(x)$ and $G_m(y)$ using Kolmogorov-Smirnov's limiting distribution. For this purpose:

1. The sets X and Y are sorted into the ordered sets $\{X_{(i)}\}$ and $\{Y_{(i)}\}$, which are nondecreasing sequences.

2. The empirical cumulative distribution functions $F_n(x)$ for the set X, and $G_m(y)$ for the set Y are computed. For example,

$$F_n(x) = \begin{cases} 0 & x < x_{(1)} \\ k/n & x_{(k)} \leq x < x_{(k+1)}; k=1,..1n-1 \\ 1 & x_{(n)} \leq x \end{cases}$$

3. The maximum difference in absolute value between the two sample distribution functions is computed:

$$D_{m,n} = \max_{x,\, y} |F_n(x) - G_m(y)|$$

The statistic $\sqrt{\frac{mn}{m+n}}\, D_{m,n}$ is a random variable with 1 limiting cumulative distribution function L(z). That is,

$$\lim_{m,n \to \infty,\infty} \text{Prob}\left\{\sqrt{\frac{mn}{m-n}}\, D_{m,n} < z\right\} = L(z)$$

4. Finally, the probability (asymptotic) of the statistic $\sqrt{\frac{mn}{m+n}}\, D_{m,n}$ being not less than its computed value, under the assumption of equality of the two theoretical distribution functions from which X and Y were taken, is computed:

$$P = 1 - L(z)$$

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